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Annual Report

2071/72 (2014/15)

Government of Nepal
Nepal Agricultural Research Council

National Maize Research Program

Rampur, Chitwan

2015

Released Maize Variety Arun-3

Conservation tillage with plastic mulch in maize- 2015

Performance of rampur hybrid 2 under various tillage and residue levels at farmers field

Released Maize Variety Arun-4

Released Maize Variety Arun-6

NMRP hybrids Rampur-2 in farmers field

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Foreword

This report is the compilation of all on-station and on-farm research activities, source seed production and distribution including financial and administrative activities for the period 16th July 2014 to 15th July 2015 carried out by the National Maize Research Program, Rampur, Chitwan. NMRP, in collaboration with national and international stake holders, is involving in maize research and development to address the issues of food and nutritional security and livelihood of the people through contribution to increasing the present production and productivity (2.458 mt /ha) of maize and maize based cropping system. Our efforts would be concentrated for benefits and livelihood improvement of Nepalese maize growers through modernizing maize R&D including development and deployment of improved maize germplasm, strengthening maize seed system, and intervention of agronomic management practices in various agro-ecologies.

I would like to express my sincere thanks to NARC management especially Executive director, Director for Crops and Horticulture, Director for Planning and Coordination, Director for Administration, Director for Finance and Director for Livestock and Fisheries for their guidance, encouragement and continuous support to improve the performance of maize research program. This report is the outcome of the joint efforts and dedication from the collaborators from RARSs, ARSs, Commodity programs, disciplinary divisions, CIMMYT, DADOs, CBOs, I/NGOs, cooperatives and agricultural groups. I would like to appreciate the hard work and painstaking efforts made by all the scientists, technical officers, technicians and support staff in conducting maize research, source seed production, data compilation, analysis and report writing. Administrative/finance staffs deserve thanks for their contribution in carrying supportive responsibilities to research activities smoothly.

I am expectant that this publication would provide the quick look of the progress made on maize research for development in Nepal and useful to concerned stakeholders. Constructive comments and noble suggestions from the readers will be highly appreciated to improve our upcoming maize research activities.

Govind KC
National Maize Coordinator
National Maize Research Program, Rampur, Chitwan, Nepal

Abbreviation and Acronyms

ABD	Agriculture Botany Division
ARS	Agriculture Research Station
ASI	Anthesis Silking Interval
BLSB	Banded Leaf and Sheath Blight
CFFT	Co-ordinated Farmer's Field Trial
CIMMYT	International Maize and Wheat Improvement Center
CV	Coefficient of Variation
CVT	Coordinated Variety Trial
DADO	District Agricultural Development Office
DAS	Days after sowing
FAT	Farmers Acceptance Test
GLS	Gray Leaf Spot
GRP	Ginger Research Program
HCRP	Hill Crop Research Program
HC	Husk Cover
IET	Initial Evaluation Trial
IYT	Intermediate Yield Trial
KUBK	Kisan ka lagi Unnat Biu Karyakram
LSD	Least Significant Difference
MNCH	Multinational Company Hybrid
NLB	Northern Leaf Blight
NMRP	National Maize Research Program
NSB	Nepal Seed Board
OPV	Open Pollinated Varieties
OR	Outreach Research
CA	Conservation Agriculture
PVS	Participatory Varietal Selection
RCBD	Randomized Complete Block Design
RCT	Resource Conservation Technology
RFFT	Regional Farmer's Field Trial
RARS	Regional Agriculture Research Station
SD	Standard Deviation
SE	Standard Error
SLB	Southern Leaf Blight
TIT	Terai and Inner Terai
WVD	Wheat Varietal Display

Table of Content

List of Tables

List of Figures

Annexes

प्रमुख सार संक्षेप

बाली प्रजनन्

राष्ट्रिय मकैबाली अनुसन्धान कार्यक्रमद्वारा विकसित मकैका वर्णशंकर जातहरु तराइ क्षेत्रमा, अवलोकन नर्सरी (ओ.वि.एन.), टेष्ट क्रस, डवल क्रस, समन्वयात्मक वर्णशंकर जातीय परीक्षण (सी.एच.टी.), किसानको खेत वारीमा गरिने परीक्षणहरु (सी.एफ.एफ.टी.) अर्न्तगत र पहाडी क्षेत्रमा समन्वयात्मक वर्णशंकर जातीय परीक्षण (सी.एच.टी.) र किसानको खेत वारीमा गरिने परीक्षणहरु (सी.एफ.एफ.टी.) मार्फत मूल्यांकन गरिएको थियो । कसीङ्ग मार्फत उपयूक्त हेटेरोटीक जोडीहरु खोज्ने उद्देश्यले चितवनको रामपुरमा मकैका २४४ वटा इन्ब्रेड अनुजातहरु लगाइएको थियो । परीक्षणको नतिजा अनुसार आर.एम.एल. ५, आर.एम.एल. ८, आर.एल. १०५, आर.एल. १९७, आर.एल. १८०, आर.एम.एल. ६२, आर.एम.एल. ६८, आर.एम.एल. ३६, एन.एम.एल. १, आर.एम.एल. ४, आर.एल. १७६, आर.एम.एल. ७६, आर.एम.एल. ५७, आर.एल. १७४, आर.एम.एल. १७, आर.एम.एल. ३२, आर.एम.एल. ८३, आर.एम.एल. ८४, आर.एम.एल. ८५, आर.एम.एल. ८६, आर.एम.एल. ९५, आर.एम.एल. ९६, आर.एम.एल. ११७, आर.एम.एल. १९ र आर.एम.एल. १ अनुजातहरु उत्कृष्ठ ठहरिए । सन् २०१४ को वर्खे मौषममा सल्यान, पाखीवास र काव्रेमा संचालित गुणस्तरीय प्रोटिनयुक्त मकैका अनुजातहरुको समन्वयात्मक जातिय परीक्षणमा एस.०१ एस.आइ.वाइ.क्यु, एस.०१ एस.आइ.डव्लु.क्यु २ र पोसिलो मकै १ सबैभन्दा बढी उत्पादन दिने अनुजातको रुपमा पाईए ।

किसानको खेत वारीमा गरिने परीक्षणहरु (सी.एफ.एफ.टी.) अर्न्तगत S99TLYQ-HG-AB, S99TLYQ-B र पोसिलो मकै १ सबैभन्दा बढी उत्पादन दिने अनुजातको रुपमा पाईए । राष्ट्रिय मकैबाली अनुसन्धान कार्यक्रम चितवन, रामपुरमा संचालित IYT-DTM परीक्षणमा सीमीट वाट प्राप्त अनुजातहरु DTM Entry#37, DTM Entry # 28 र एन.एम.आर.पी अनुजातहरु Rampur So3Fo8 र TLBRS07F16 (3419 kg/ha) सबैभन्दा बढी उत्पादन दिने अनुजातको रुपमा पाईए । अनुजातहरु DTM Entry#35, Entry # 25, Entry # 22 र Entry # 21 सबैभन्दा बढी उत्पादन दिने अनुजातहरुको (५ टन/हे.भन्दा बढी) रुपमा पाईए । जुम्लामा गरिएको परीक्षणमा अनुजातहरु Karnali Pool White, Ganesh 1, KKT-01, JML-34, र KKT-14 सबैभन्दा बढी उत्पादन दिने अनुजातको रुपमा पाईए । रा.म.बा.अ.का. चितवन, रामपुरमा संचालित हिउंदे CVT परीक्षणमा, अनुजातहरु Karnali Pool yellow (2182 kg/ha, KEY (2165 kg/ha), RLW-Pop (2150 kg/ha) र KEW-Pop (2008 kg/ha) सबैभन्दा बढी उत्पादन दिने अनुजातको रुपमा पाईए ।

राष्ट्रिय मकैबाली अनुसन्धान कार्यक्रम द्वारा चाडै पाक्ने जातहरु अरुण-३, अरुण-४, र अरुण-६ को सिफारीस गरीएको छ । अरुण-३ को उत्पादकत्व ३.९ टन/हे. र पाक्ने अवधि

१०० दिन रहेको छ । त्यसैगरी अरुण-४ को उत्पादकत्व ४.२ टन/हे. र पाक्ने अवधि ११३-११५ दिन रहेको छ । अरुण-६ को उत्पादकत्व ३.५ टन/हे. र पाक्ने अवधि ९० दिन रहेको छ । यी तिनै वटा जातहरुको सिफारिश ठाउँ भने मध्य पश्चिमदेखी पूर्व तराई, भित्री मधेश र मध्य पहाड रहेको छ । जाडो र बसन्त मौसममा तराइ र भित्री मधेश तथा बर्षात मौसममा मध्य पहाडमा यी जातहरु लगाउन सकिन्छ ।

लामो समयमा पाक्ने जातहरुको पहाडी सेटको पाखिबास्, खुमलटार, लुम्ले, र दैलेखमा गरिएको प्रारम्भिक उत्पादन परीक्षणहरुको संयुक्त विश्लेषण गर्दा रामपुर एस१०एफ२२ ले सबैभन्दा बढि (७३८८.९२ केजी/हे) उत्पादन दिएको पाइयो । त्यसपछि बढि उत्पादन दिनेमा क्रमश: मनकामना-३ (७३५६.०६ केजी/हे) र आर पप-२ (७१४२.३ केजी/हे) देखियो । लामो समयमा पाक्ने जातहरुको पहाडी सेटको गरिएको समन्वयात्मक जातिय परीक्षणहरुको संयुक्त विश्लेषण गर्दा मनकामना-३ ले सबैभन्दा बढि (६२८७.६६ केजी/हे) उत्पादन दिएको पाइयो । त्यसपछि बढि उत्पादन दिनेमा क्रमश: ०७ एसएडिभिआई (५६६५.३९ केजी/हे) र रामपुर एस ०३ एफ ०४ (५३८९.१७ केजी/हे) देखियो । लामो समयमा पाक्ने जातहरुको पहाडी सेटको पाखिबास्, लुम्ले र सल्यानमा गरिएको समन्वयात्मक कृषकको खेतको परीक्षणहरुको संयुक्त विश्लेषण गर्दा एक्स ९९४२/एक्स ९९४४ ले सबैभन्दा बढि (५०२५.९४ केजी/हे) उत्पादन दिएको पाइयो । त्यसपछि बढि उत्पादन दिनेमा क्रमश: मनकामना - ३ (५०२५.५० केजी/हे) र बि जि बि वाई पप (४९७६.८७ केजी/हे) देखियो ।

लामो समयमा पाक्ने जातहरुको तराई सेटको नेपालगन्ज, डोटि र रामपुरमा गरिएको प्रारम्भिक उत्पादन परीक्षणहरुको संयुक्त विश्लेषण गर्दा आर पप-४ ले सबैभन्दा बढि (५२८७.२३ केजी/हे) उत्पादन दिएको पाइयो । त्यसपछि बढि उत्पादन दिनेमा क्रमश: सेल-०एचजिवाईए × सेल-०एचजिवाईबि (५२०७.०० केजी/हे) र आर पप-१ (४९९९.६६ केजी/हे) देखियो । लामो समयमा पाक्ने जातहरुको तराई सेटको सुर्खेत, डोटि र रामपुरमा गरिएको समन्वयात्मक जातिय परीक्षणहरुको संयुक्त विश्लेषण गर्दा रामपुर एस १३ एफ २४ ले सबैभन्दा बढि (३४५१.९४ केजी/हे) उत्पादन दिएको पाइयो । त्यसपछि बढि उत्पादन दिनेमा क्रमश: टाक्फा-एस-९५३६ (३२३६.१७ केजी/हे) र रामपुर एस१३एफ१६ (३२०२.९७ केजी/हे) देखियो । लामो समयमा पाक्ने जातहरुको तराई सेटको डोटि र रामपुरमा गरिएको समन्वयात्मक कृषकको खेतको परीक्षणहरुको संयुक्त विश्लेषण गर्दा एक्स ९३३१ आर ई ले सबैभन्दा बढि (५३२८.१६ केजी/हे) उत्पादन दिएको पाइयो । त्यसपछि बढि उत्पादन दिनेमा क्रमश: एच जि-ए बि (३७८५.७२ केजी/हे) र एच जि-ए (३३८९.४७ केजी/हे) देखियो ।

अरुण २, मनकामना ३ र पोषिलो मकै १ मा ग्रिड छनौट पुरा गरियो । त्यसैगरि, कम्पोजिट र देउतीमा हाफसिब फेमिलि छनौट पुरा गरि क्रमश: ५ के.जी. र ४ के.जी.न्युक्लियस बीउ उत्पादन गरियो ।

बाली विज्ञान

तराइमा मकैबाली प्रणालीमा झारपातको व्यवस्थापनको उत्तम विधि पत्ता लगाउने उद्देश्यले गरिएको एक परीक्षणमा खनजोतका दुवै बिधिहरु परम्परागत कृषि र संरक्षण कृषिमा ६ वटा झारनाशक प्रविधिहरुको परीक्षण गरिएको थियो । झारपातको घनत्व (चौडापाते, साँघुरोपाते र मोथे प्रजाति) संरक्षण कृषिमा भन्दा परम्परागत कृषि गरिएको प्लटमा बढी पाइयो । यसरी नै एट्राजिन ०.७५ के.जी. प्रति हेक्टर र ग्लाइफोसेट २.५ मिलि लिटर प्रति लिटरका दरले ट्यांक मिश्रण गरी प्रयोग गरेको अवस्थामा प्रति इकाइ क्षेत्रफलमा झारपातको घनत्व उल्लेख्य रुपमा कमी पाइयो । यही विधिद्वारा झारपातको व्यवस्थापन गरिएकोमा मकैको बाली उत्पादन र सम्बन्धित तत्वहरु (घोगाको संख्या, दानाको संख्या, दानाको तौल) अन्य विधिमा भन्दा बढी रेकर्ड गरिएको थियो । एट्राजिन ०.७५ के.जी. प्रति हेक्टर र ग्लाइफोसेट २.५ मिली लिटर प्रति लिटरका दरले ट्यांक मिश्रण गरी प्रयोग गरेको अवस्थामा प्रति इकाइ क्षेत्रफलमा खुद नाफा र लागत अनि लाभको अनुपात पनि २.३३ रेकर्ड गरिएको थियो ।

संरक्षण कृषि र परम्परागत कृषि प्रविधि बीचको तुलनात्मक अध्ययन गर्दा खनजोत नगरेको प्लटमा धानको परालको छापो (जमिनबाट ३५ से.मी. माथि काटेर ठाडै छोडेको) प्रयोग गरेर लगाइएको मकैको वानस्पतिक तथा बाली उत्पादनमा प्रत्यक्ष प्रभाव पार्ने तत्वहरु जस्तैः घोगाको संख्या, घोगामा मकैको दानाको हार संख्या, प्रति हार दानाको संख्या र दानाको तौल (१००० दानाको तौल ग्राममा) र मकैको औसत उत्पादन (४.५४५ मेटन प्रति हेक्टर परम्परागत रुपमा खनजोत गरी लगाइएको मकै (४.२७४ मेटन प्रति हेक्टर) मा भन्दा बढी पाइयो । यसरी नै छरुवा धानको औशत उत्पादन (३.६३२ मेटन प्रति हेक्टर) परम्परागत रुपमा खनजोत गरी लगाइएको धानको (३.२५४ मेटन प्रति हेक्टर) मा भन्दा बढी पाइयो । यसरी मकै-धान बाली प्रणालीमा छैठौं सिजनसम्म विना खनजोत छापो राखेर लगाइएको मकैमा बाली उत्पादन, विरुवाको वृद्धि तथा प्रतिफलमा सकारात्मक प्रभाव परेको पाइयो भने माटोको उर्वराशक्तिमा पनि उल्लेख्य प्रभाव परेको पाइयो, परम्परागत रुपमा खनजोत गरेकोमा २.९५ प्रतिशत र विना खनजोतमा २.९६ प्रतिशत प्राङ्गारिक पदार्थको मात्रा पाइएको छ ।

२०७१ को हिउँदमा संरक्षण कृषि अन्तर्गत रा.म.अ.का. रामपुर चितवनमा गरिएको परीक्षणमा परम्परागत तरिकाको खनजोत गरेर लगाएको भन्दा खनजोत नै नगरी त्यसमा छापो राखेर खेती गरेको मकै बढी उत्पादन भएको पाइयो । जसमा रामपुर कम्पोजिट जातको मकैले खनजोत नगरी छापो राखेको प्लटमा सबै भन्दाबढी (६२९८ के.जि./हे.) उत्पादन दिएको पाइयो भने वर्णशंकर RML-32/RML-17 जातमा पात डढुवा रोग (Turcicum Leaf Blight) का कारण कम (५९८० के.जि./हे) उत्पादनभएको थियो । यस वर्ष वर्णशंकर

जात RML-4/RML-17 र RML-32/RML-17 मा पात डढुवा रोग (H.Turcicum) का कारण उत्पादनमा ह्रास आएको थियो ।

मकैको हाइब्रिडमा गरिएको बालीको घनत्व सम्बन्धि अध्ययनमा प्रति हेक्टर जमिनमा ६६,६६६ (६० × २५सेमी) बोट राख्नाले बालीको उत्पादकत्व बढी हुने तथा आर्थिक लाभ (लागत अनि लाभको अनुपात) पनि हालसम्म सिफारिस गरिएको ५३,३३३ बोट प्रतिहेक्टर भन्दा अधिक नै पाइएको थियो ।

मकैको हाइब्रिडमा गरिएको नाइट्रोजनको उपयुक्त मात्रा सम्बन्धि अध्ययनमा प्रति हेक्टर जमिनमा १२० केजी नाइट्रोजनका हिसाबले प्रयोग गरिएको अवस्थामा बालीको उत्पादकत्व बढी (८३८३ केजी प्रति हेक्टर) हुन गई आर्थिक लाभ (लागत अनि लाभको अनुपात) पनि हालसम्म सिफारिस गरिएको १२० केजी नाइट्रोजन प्रति हेक्टर भन्दा बढी नै पाइएको थियो ।

कात्तिक १५ देखि मंसिर १ सम्ममा मकै र राजमा अन्तरबालीको परीक्षण लगाउँदा रामपुर कम्पोजिट मकैको लाइनदेखि लाइनको दूरी १०० सेमी र राजमाको ५० सेमी दूरीमा रोप्दा मकै बालीको उत्पादन ४४०७ र राजमाको २४७१ केजी प्रति हेक्टर पाइएको थियो भने एल.इ.आर. पनि १.९७ रेकर्ड गरिएको थियो ।

त्यस्तै गरी रामपुरमा हिउँदमा मंसिर १ मा मकै र राजमा अन्तरबाली परीक्षण लगाउँदा मकैको जात रामपुर कम्पोजिटलाई हारदेखि हारको दूरी १०० सेमीको बीचमा ५० सेमी दूरीमा राजमा लगाउँदा मकैबालीको उत्पादन प्रत्येक १५ दिन ढिला रोप्दा प्रति हेक्टर १०० केजी उत्पादन घट्दै जाने नतिजा अनुसन्धानले देखाएको छ ।

माटो विज्ञान

सन् २०१५ को हिउँदे मौसममा मकैका चार विभिन्न जातहरु र नाईट्रोजन, फस्फोरस र पोटास मलका विभिन्न मात्राहरु प्रयोग गरी गरिएको संयुक्त परीक्षण (VCFT) मा RML32×RML17, RML4×RML17, Across 9331 र S99TLYQ-B ले १८०:९०:६० ना.फ.पो.किलो/हे.दरमा प्रयोग गर्दा सबैभन्दा बढी उत्पादन क्रमशः ६८५३ के.जी./हे., ६१९२ के.जी./हे. ४८८७ के.जी./हे.र ६३५६ के.जी./हे. दिएको पाइयो ।

सन् २०१५ को बर्खे मौसममा रामपुरमा गरिएको परीक्षणमा अरुण ३ जातले ६० के.जी. नाईट्रोजन शुरुमा र ६० के.जी.नाईट्रोजन मकै रोपेको ४५ दिनमा प्रयोग गर्दा सबै भन्दाबढी २५३४ के.जी./हे.उत्पादन दिएको पाइयो ।

त्यसैगरी बर्खे मौसममा S99TLYQ-B मा गरिएको परीक्षणमा ६० के.जी. नाईट्रोजन शुरुमा र ६० के.जी.नाईट्रोजन मकै रोपेको ४५ दिनमा प्रयोग गर्दा यस जातले सबैभन्दा बढी ५८६० के.जी./हे उत्पादन दिएको पाइयो । त्यसै गरी सोही परीक्षणमा ३० के.जी. नाईट्रोजन मकै रोपेको समयमा र बांकी नाईट्रोजन ३० के.जी.का दरले १५ दिनको फरकमा ३०, ४०, र ६० दिनमा प्रयोग गर्दा ५८६० के.जी./हे उत्पादन दिएको पाइयो ।

सन् २०१४/०१५ को हिउँदे मौसममा रामपुरमा गरिएको पाँचवटा ईन्ब्रेड लाईनहरुको परीक्षणमा ईन्ब्रेड लाईनहरु RML 32, RML 17, RML 96, RML 95 र RML 4 ले सबैभन्दा बढी उत्पादन क्रमश: १६०१ के.जी./हे (१२०:९०:४० ना.फ.पो.किलो/हे. दरमा प्रयोग गर्दा), २६८७ के.जी./हे (१५०:९०:४० ना.फ.पो.किलो/हे. दरमा प्रयोग गर्दा), ७०१ के.जी./हे (१८०:९०:४० ना.फ.पो.किलो/हे. दरमा प्रयोग गर्दा), ८४४ के.जी./हे (१५०:६०:४० ना.फ.पो.किलो/हे.दरमा प्रयोग गर्दा) र ६२७ के.जी./हे (१२०:९०:४० ना.फ.पो.किलो/हे. दरमा प्रयोग गर्दा), दिएको पाइयो ।

त्यसैगरी सोही समयमा हाईब्रिड जात RML32 × RML17 मा नाईट्रोजन, फस्फोरस र पोटासका विभिन्न मात्राहरु प्रयोग गरी गरिएको परीक्षणमा यस जातले ९३२७ के.जी./हे (१६०:६०:६० ना.फ.पो.किलो/हे. दरमा प्रयोग गर्दा) उत्पादन दिएको पाइयो ।

रोग व्यवस्थापन

पाखीवासमा सन् २०१४ को गर्मी मौसममा गरिएको परीक्षणमा GLS अबरोधक अनुजातहरुमा P501SRCO/P502SRCO, 05SADVI, Entry # 36 र Entry # 27 पाइयो । काभ्रेपलान्चोकको ढुङ्गीखर्कमा ZM-401, ZM-627, 05SADVI, 07SADVI, TLBRSO7F16, ENTRY#33, ENTRY#24, ENTRY#32 र ENTRY#21 त्यस्तै सल्यानमा 05SADVI, 07SADVI, ACROSS-9942/ACROSS-9944, BGBYPOP, ENTRY # 24 र ENTRY# 32 पाइयो । अनुजात 07SADVI को सबैभन्दा वढी उत्पादन (८६३८ के.जी. प्रति हेक्टर) रेकर्ड गरियो ।

रामपुरमा सन् २०१४ को गर्मी मौसममा गरिएको परीक्षणमा ear rot (घोगा कुहिने रोग) अबरोधक जातहरुमा RML-6/RML-7, RML-32/RML-17, RML-4/RML-17, Rampur hybrid-2, RL-4//RL-111, (RML-68/RL-101)/(RML-8/RML-62), KYM-33/KYM-35,RML-68/RL-101,(RML-174/RML-36)/(RML-6/RML-19), Rajkumar र Rampur composite पाइयो ।

त्यसैगरी देशका विभिन्न स्थानहरुमा गरिएको परीक्षणमा मकैका कुनैपनि अनुजातहरु उतरी पात डढुवा रोग, दक्षिणी पात डढुवा रोग र वी.एल.एस.वी रोग विरुद्ध अबरोधक पाइएन ।

कीटविज्ञान अनुसन्धान

ट्राइकोग्रामा एक किसिमको वारुलो हो जसले पुतली समूहका कीराहरुको फुललाई खाएर वालीविरुवामा ति किराहरुवाट हुने हानीवाट बचाउछ । यस परजीवीको प्रयोग हुने संख्या निर्धारणको लागी रामपुरमा एउटा परीक्षण संचालन गरिएको थियो जसमा ट्राइकोग्रामाको चारवटा समुह र एउटा रसायनिक विषादी गरेर पांचवटा उपचार पद्धती प्रयोग गरिएको थियो । जसमा ट्राइकोग्रामा वारुलो ८०,००० प्रति हे २ पटक, ८०,००० प्रति हे ३ पटक, ६०,००० प्रति हे २ पटक र ६०,००० प्रति हे ३ पटक र डाइमेथोएट १.५ मि लि प्रति लिटर पानीमा मिसाएर २ पटक प्रत्येक १५ दिनको फरकमा छरिएको थियो । रेकर्ड गरिएका गबारोको क्षतिहरु जस्तै डाठमा खाएको मात्रा, डाठमा प्वालको संख्या, र अन्य उत्पादनमा मापन गुणहरु जस्तै बोटको उचाइ, घोगाको संख्या, १००० दानाको तौल, उत्पादन जस्ता मापकहरु उपचार पद्धती अनूसार फरक पाइएन ।

२०७१/७२ मा राष्ट्रिय मकैबाली अनुसन्धान कार्यक्रम, रामपुरमा ४० वटा राम्रा देखिएका जातहरुलाई मकैमा लाग्ने धर्के गवारोको अबरोधक जातहरुको छनौट परीक्षणमा राखिएको थियो जसमा Across9942/Across 9944, BGBYPOP, Arun 1 EV, OEHPW, R-POP-1, RampurSO3FQ02, Rampur S10F18, S99TLYQ-B, S00TLYQ-B, RML-32 × RML-17, RML-4 × RML-17, RML-95 × RML-96, RML-87 × RL-105, RML-86 × RML-96 जातहरुमा अन्य जातको तुलनामा गवारोको क्षति कम भएको पाइयो । त्यसै गरी उक्त गवारो कीरा नियन्त्रणको लागि बजारमा प्रचलनमा आएका बिभिन्न बिषादीको परीक्षण गरिएको थियो जसमा (क्लोरोपाइरीफस ५० ई.सी.+ साइपरमेथ्रीन ५ ई.सी.) १.५ मी.ली. प्रति लिटर, स्पीनोस्याड ४५% ई.सी. ०.५ मि.ली. प्रति लिटर, फ्यूराडन ३ जी ३-४ दाना प्रति बोट र क्लोरोपाइरीफस २० ई.सी. १.५ मि.ली. प्रति लिटर पानीका दरले प्रयोग गर्दा नतिजा राम्रो पाइयो । त्यसै गरी मकै भण्डारणमा लाग्ने कीरा व्यवस्थापनको लागि बिभिन्न ६ थरिका भण्डारण भाँडाहरुमा १२ प्रतिशत तथा १५ प्रतिशत चिस्यान कायम गरी परीक्षण संचालन गरिएको थियो । चार महिना पछिको नतिजा अनुसार सुपर ग्रेन ब्याग, बिना बिषादी बीउ तथा खाद्यन्न भण्डारण ब्याग (पिआईसियस ब्याग) र २०० गेजको प्लाष्टिक ब्यागमा भण्डारण गरिएको मकैमा दुवै अवस्थामा घुन, पुत्लाले कम क्षति गरेको पाइयो । त्यसै गरी मकै भण्डारणमा स्थानिय स्तरमा पाइने बिभिन्न बनस्पतिहरुको प्रयोग गरि परीक्षण संचालन गरिएको थियो जसमा बोझोको जराको धुलो २० ग्राम प्रति के.जी, निमको दानाको धुलो १० ग्राम प्रति के.जी का दरले उपचार गर्दा ४ महिनासम्ममा भण्डारणमा लाग्ने कीराहरुबाट कम क्षति भएको पाइयो ।

बाह्य अनुसन्धान

कृषकको खेतमा गरिएको बिभिन्न्न सहभागितामुलक परीक्षणहरुबाट देखिएका मकैका राम्रा जातहरु मध्ये मकैको बर्णशंकर जातहरुमा बढि उत्पादन दिने उन्मोजित जात Rampur Hybrid-2 र (RML-95/RML-96)/RML-17 (९.५ टन/हे), RML-86/RML-96 (९.२ टन/हे), पुरा समयमा पाक्ने जातहरुमा Upahar (६.४ टन/हे), HG-A (५.८ कीलो/हे) र Across-9331 (५.१ टन/हे) पाइयो । त्यसैगरी गुणस्तरीय प्रोट्रिनयुक्त मकैको परीक्षणमा S99TLYQ-B (६.४७ टन/हे) र SO3TLYQ-AB-02 (६.०२ टन/हे) मा उत्पादन बढि पाइयो । चाँडो पाक्ने जातहरुमा EEYC-1 (५.० टन/हे) र Pool-16 E (४.५ टन/हे) बढि उत्पादन पाइयो । त्यसैगरी धानको पुरा सयम लाग्ने जातिय परीक्षणमा IR-87615-9-3-1-3 (४.७४ टन/हे), IR-81826-B-B-5-7 (४.४३ टन/हे), छिटो पाक्ने धानको जातहरुमा IR-64683-87-2-2-3-3 (४.७४ टन/हे), हर्दिनाथ-१ (४.७५ टन/हे) मा बढि उत्पादन पाइयो । त्यसैगरी बास्नादार धानमा, IR-77542-90-1-1-1-1-5 (४.०६ टन/हे) र IR-77539-80-2-2-2 (३.९५ टन/हे) मा बढि उत्पादन पाइयो । गहुँको जातिय परीक्षणबाट BL-4316 (३.३६ टन/हे), NL-1172 (३.१२ टन/हे) ले बढि उत्पादन दिएको पाइयो ।

समन्वयात्मक जातिय परीक्षण

धान

धान बालीमा आ. ब. २०७१/७२ मा जम्मा तिन वटा जातिय परीक्षणहरु र एउटा रोग संम्बन्धि परीक्षण लगाईएको थियो । जातिय परीक्षणहरु मध्येमा उपयुक्त समयमा पाक्ने समन्वयात्मक जातिय सेट (CVT-Normal) मा ३० वटा धानका जातहरु समावेश गरिएको थियो । परीक्षणको नतिजा अनुसार एन. आर. २१५८–१३–१–२–४–१ (५.१ टन प्रति हे.), एम. टि. यू. ११५ (४.७ टन प्रति हे.) र एन. आर. २१५७–१४४–१–३–१–१–१ (४.७ टन प्रति हे.) हरु बढि उत्पादन दिने पाईएको छ । त्यस्तै अर्को परीक्षणको सेटमा मसिनो तथा वास्नादार सेट (CVT-FAR) लगाईएको थियो जसमा १६ वटा जातहरु समावेश गरिएको थियो र यस मध्ये बढि उत्पादन दिने तथा उत्कृष्ट जातहरु आई. आर. ९४७८–६७–३–३–२ (५ टन प्रति हे.), आई. ई. टि. १७२७८ (४.४ टन/हे) र आई. आर. ७८००६–५५–२–३–३ (४.४ टन/हे) रहेका छन । त्यस्तै अर्को धानको परीक्षणमा चाडो पाक्ने (CVT-RLE) २६ वटा जातहरु मध्ये राधा ४ (४.२ टन/हे), आई. आर. ४८८५९–बि–८६–३–१ (४.१ टन/हे) र आई. आर. ८०४०८–बि–४३–३ (४.१ टन/हे) ले बढि उत्पादन दिएका छन । धानबालीमा डढुवा रोग (NRBN) संम्बन्धि परीक्षणमा संलग्न ३३० धानका जातहरु मध्ये

४६ वटा जात हरुमा डढुवा रोगको आक्रमण पाईएन र १०२ जातहरुमा रोगको प्रकोप अति न्यून मात्रमा रहेको पाइयो ।

गहु

गहु बालीमा आ. ब. २०७१/७२ मा जम्मा चार वटा जातिय परीक्षणहरु र एउटा रोग संम्बन्धि परीक्षण लगाईएको थियो । जातिय परीक्षणहरु मध्येमा प्रारम्भिक मूल्याङ्कन (IET) मा ३० वटा जातहरु समावेश गरिएकोमा बढि उत्पादन दिने जातहरु कमश एन. एल. १२४४ (३.८ टन/हे.), एन. एल. १२४९ र एन. एल. १२५४ (३.६ टन/हे.) पाईएको छ । त्यस्तै समन्वयात्मक जातिय परीक्षण (CVT) मा २० वटा गहुका जातहरु समावेश गरिएको थियो । परीक्षणको नतिजा अनुसार बि. एल. ४४०६ (३.४ टन/हे.), बि. एल. ४४०७ र एन. एल. १२११ (३.३ टन/हे) जातहरु सबैभन्दा बढि उत्पादन दिने पाईएको थियो । अर्को गहुको परीक्षण अन्तर्गत जातिय प्रदर्शनी (WVD) मा ४३ जातहरु समावेश गरिएकोमा सबैभन्दा बीढ ढिटिकेलले ५.२ टन प्रति हे., धौलागिरीले ४.७ टन प्रति हे. र बि. एल. ३६२३ ले ४.६ टन प्रति हे. उत्पादन दिएको पाईएको थियो । त्यस्तै अर्को एक परीक्षण अन्तर्गत सुख्खा सहन सक्ने (NRN) सेटमा १०० वटा जातहरु समावेश गरिएको थियो र यस परीक्षणमा सबै जसो जातहरुको उत्पादन एक टन भन्दा कम रहेको पाईएको थियो । गहुको रोग संम्बन्धि परीक्षणमा (NWDSN) ३३० वटा जातहरु समावेश गरिएकोमा ६ वटा जातहरुमा पात डढने रोग (SAUAL/3/ACHTARx3//KANZ/KS85-8-4/4/SAUAL, ACHU#1/4/CROC_1/,ATTILAx2/PBW65//MURGA,WBLL1/KUKUNA//,ATTILIA/3x BCN//BAV92/3/TILHI/4/SUP152, DURUM) अति कम पाइयो भने ८ वटा जातहरु रोग सहन सक्ने खालको पाइयो ।

श्रोत बीउ उत्पादन

समग्रमा आ.व. २०७१/७२ मा , ५१.८१३ टन मकैको बीउ उत्पादन भएको थियो । रामपुर कम्पोजिट अन्तर्गत १,४८१ किलो प्रजनन् बीउ, १५,८०८ किलो मुलबीउ र ३,९३० किलो उन्नत बीउ उत्पादन भएको थियो । त्यसैगरि, अरुण-२ अन्तर्गत ७०० किलो प्रजनन् बीउ, ७,१०० किलो मुल बीउ र ५,८२५ किलो उन्नत बीउ उत्पादन भएको थियो । मनकामना-३ अन्तर्गत १,१४९ किलो प्रजनन् बीउ, ७,६२६ किलो मुल बीउ र ५,३३९ किलो उन्नत बीउ उत्पादन भएको थियो । त्यसैगरि, देउती अन्तर्गत १५० किलो प्रजनन् बीउ, २,२७५ किलो मुल बीउ र ५० किलो उन्नत बीउ उत्पादन भएको थियो । पोषिलो मकै अन्तर्गत ११० किलो प्रजनन् बीउ र २७० किलो मुल बीउ उत्पादन भएको थियो । त्यसै गरी धान, गँहु र सनहेम्पमा कमश: २४,२३१, ४०,७०२ र १,०५० किलो मुल बीउ उत्पादन भएको थियो ।

विशेष आयोजनाहरु

१. कृषि तथा खाद्य सुरक्षा आयोजना

तिन समुहका उन्मोचन्मुख मकैका जातहरुको संरक्षण संवर्धन तथा रा.म.बा.अ.का. बाट उत्पादित कुल मध्य ४०० केजी प्रजनन् बीउ र ४००० केजी मुल बीउ केन्द्र भित्र उत्पादन गरीएको र १२१० केजी प्रजनन् बीउ तथा २७६० केजी मुल बीउ कृषि तथा खाद्य सुरक्षा आयोजना अन्तर्गतका जिल्लाहरुलाई उपलब्ध गराईएको थियो । कृषि अनुसन्धान केन्द्र, सुर्खेत तथा अदुवा अनुसन्धान केन्द्र, सल्यान अन्तर्गतका चारवटा समुदायमा आधारित बीउ उत्पादक समुहहरुलाई दुई दिने मकैको बीउ उत्पादन तालिम दिइएको थियो ।

२. किसानका लागि उन्नत बिउ बीजन कार्यक्रम

गुल्मि र अर्घाखाची दूवै जिल्लाका एक एक वटा समुदायमा आधारित बिउ उत्पादक समुहहरुलाई मुल बिउ उत्पादन कार्यक्रममा सहयोग गरीएको थियो । गुल्मिमा रामपुर कम्पोजिट र मनकामना ३ का लागि क्रमशः ९ हेक्टर र ८ हेक्टरमा र अर्घाखाचीमा रामपुर कम्पोजिट का लागि १० हेक्टरमा मुल बीउ उत्पादन कार्यक्रम संचालन भएको थियो । कार्यक्रमका लागी प्रजनन् बीउ, युरिया, किटनाशक विषादि, सिड बिन, त्रिपाल, जुटको बोरा (समुहको लोगो भएको), जुटको बोरा सिलाउने मेशिन, डिजिटल तराजु तथा विद्युतिय मकै छोडाउने मेशिन दूवै समुहलाई उपलब्ध गराईएको थियो । त्यसका अतिरिक्त दुई दिने मकै बीउ उत्पादन तथा पि भि एस तालिम पनि संचालन भएको थियो ।

EXECUTIVE SUMMARY

Plant Breeding

NMRP developed hybrids were evaluated under observation nursery (OBN), test crosses (TC), double cross hybrids, coordinated hybrid trials (CHT) and coordinated farmer's field trials (CFFT) in terai regions and in hills CHT and CFFT were conducted. At Rampur a total of 244 fixed inbred lines were planted for *per se* performance and for finding heterotic partners each other by crossing. Out of all tested inbred some outstanding for *per se* performance and good for combining ability were RML-5, RML-8, RL-105, RL-197, RL-180, RML-62, RML-68, RML-36, NML-1, RML-4, RL-176, RML-76, RML-57, RL-174, RML-17, RML-32, RML-83, RML-84, RML-85, RML-86, RML-95, RML-96, RML-98, RML-117, RML-19 and RML-120.

The results of CVT in 2014 summer season showed that at Salyan, Pakhribas and Kabre the combined analysis across locations revealed that all the tested Genotype were highly significant for grain yield, tasseling days, silking days, ear height and significant for plant height. Selection of high yielding QPM Genotype for a particular location is the most important task in QPM development program. In CVT, S01SIYQ, S01SIWQ-2 and Poshilo Makai-1 were found high yielding Genotype across years and locations. In CFFT, S99TLYQ-HG-AB, S99TLYQ-B and Poshilo Makai-1 were found superior for grain yield Genotype across years and locations. Superior varieties in CVT should be further tested in CFFT and superior varieties in CFFT should be forwarded for release and be recommended to farmers of hill districts of Nepal for general cultivation. In IYT-DTM, at NMRP, Rampur CIMMYT Material DTM Entry#37 ,DTM Entry # 28),and NMRP material; ie. Rampur So3Fo8 and TLBRS07F16 (3419 kg/ha) were superior in terms of grain yield. The Genotype DTM Entry#35, Entry # 25, Entry # 22, and Entry # 21 were high yielder and had more than 5 tons/ha grain yield. The Genotype Karnali Pool White, KKT-01, JML-34, and KKT-14, were found superior in their grain yield potentiality in Jumla district condition as compared to checks varieties. The genotype Ganesh-1 was found best in Jumla district in terms of grain yield. So these Genotype were found suitable Genotype for Karnali region. Among the tested 10 Genotype; Karnali Pool yellow (2182 kg/ha, KEY (2165 kg/ha), RLW-Pop (2150 kg/ha),) and KEW-Pop (2008kg/ha.) were found superior in CVT at Rampur during winter, 2071as compared to Ganesh-1.

The early variety namely Arun-3, Arun-4 and Arun-6 has been released. The productivity and maturity day of Arun-3 is 3.9 t/ha and 100 day respectively. Its recommended domain is Mid western to Eastern Terai, Inner Terai and Mid hills; winter and spring season in Terai and Inner Terai, and summer season in mid hill. Similarly, the productivity and maturity day of Arun-4 is 4.2 t/ha and

113-115 day respectively. Its recommended domain is Mid western to Eastern Terai, Inner Terai and Mid hills; winter and spring season in Terai and Inner Terai, and summer season in mid hill. Likewise the productivity and maturity day of Arun-6 is 3.5 t/ha and 90 day respectively. Its recommended domain is Mid western to Eastern Terai, Inner Terai and Mid hills; winter and spring season in Terai and Inner Terai, and summer season in mid hill.

The combined analysis of IYT full season hill set across Pakhribas, Khumaltar, Lumle and Dailekh showed that RAMPUR S10F22 produced the highest yield (7388.92 kg/ha) followed by Manakamana-3 (7356.06 kg/ha) and R-POP-2 (7142.3 kg/ha) respectively. Combined analysis of CVT full season hill set showed that Manakamana-3 produced the highest yield (6287.66 kg/ha) followed by 07SADVI (5665.39 kg/ha) and Rampur S03F04 (5389.17 kg/ha) respectively. The combined analysis of CFFT full season hill set across Pakhribas, Lumle and Salyan showed that Across 9942/Across 9944 produced the highest yield (5025.94 kg/ha) followed by Manakamana-3 (5025.5) kg/ha) and BGBYPOP (4976.87 kg/ha) respectively.

The combined analysis of IYT full season terai set across Nepalgunj, Doti and Rampur showed that R POP-4 produced the highest yield (5287.23 kg/ha) followed by CEL-0HGYA × CEL-0HGYB (5207.00 kg/ha) and R-POP-1 (4999.66 kg/ha) respectively. Combined analysis of CVT full season terai set conducted at Doti, Surkhet and Rampur showed that Rampur S13 F24 produced the highest yield (3451.94 kg/ha) followed by TAKFA-S- 9536 (3236.17 kg/ha) and Rampur S13 F16 (3202.97 kg/ha) respectively. Combined analysis of CFFT full season terai set conducted at Doti and Rampur showed that Across 9331 RE produced the highest yield (5328.16 kg/ha) followed by HG-AB (3785.72 kg/ha) and HG-A (3389.47 kg/ha) respectively.

Grid selection was completed in Arun-2, Manakamana-3 and Poshilo Makai-1. Half sib family selection was completed in Rampur Composite and Deuti and 5 kg and 4 kg nucleus seed was produced in those varieties respectively.

Agronomy

In an experiment having 3 factors each with two levels i.e. tillage (conventional tillage and no tillage), residue management (residue kept and removed) and cropping system (maize- wheat and maize + soybean-wheat): System yield was significantly highest (17412.7 kg/ha) in zero tilled and residue kept field intercropped maize with soybean followed by wheat. The lowest system yield (11770.7 kg/ha) was recorded in no tilled and residue removed plot with no intercropping of soybean followed by wheat. Residue kept field had higher SOM (3.73 %) as compared to residue removed (3.49%). A field planted with maize and soybean followed by wheat had the highest value of SOM i.e. 3.66 % over

the field with sole maize followed by wheat with 3.57 %. Maize and soybean followed by wheat had the highest value of nitrogen i.e. 0.172% over the field with sole maize followed by wheat with 0.165%. Higher value of available P_2O_5 was in NT (33.26 kg/ha) over CT (32.59 kg/ha), however the soil available K_2O content did not vary due to tillage methods.

An experiment under rice-maize system having four factors each with two levels i.e. tillage (no tillage and conventional tillage), residue (kept and removed), nutrient (recommended doses of nutrients i.e. 120:60:40 NPK kg/ ha for maize and 100:30:30 NPK kg/ha for rice and farmers practice of 10 t FYM +70:30:50 NPK kg/ha for maize and 10 t FYM + 50:20:0 NPK kg / ha for rice) and weed management (manual and herbicide : Atrazine @1.5 kg ai/ha for maize and Pendimethalin @1 kg ai/ha for rice as pre-emergence applications: No till recorded the highest grain yield of maize (4,545 kg/ha) over conventional tillage. Similarly, residue retained, recommended doses of nutrient and application of herbicide produced the higher grain yields (5,982, 6,644 and 4,680 kg/ha respectively) over residue removed, farmers doses of nutrients and manual weeding. Application of recommended dose of nutrient produced significantly higher harvest index in maize (47.79%) as compared to farmer's doses of nutrient (45.28%). Grain yield of rice under no tillage, residue kept and recommended dose of fertilizer was found significantly higher with 3633.22, 3665.88 and 5851.01 kg/ha respectively as compared to conventional tillage, residue removed and farmers' dose of fertilizer having 3254.31, 3223.98 and 1037.4 kg/ha respectively. Tillage methods and residue levels affected the soil organic matter (SOM %) after the harvest of the crop. NT had the higher SOM of 2.96% compared to conventional tillage methods (2.953). Similarly, residue kept plot had higher (3.194%) SOM over residue removed (2.724).

In a trial having two levels of tillage (no tillage and conventional tillage), two genotypes (Rampur Hybrid-2 and RML-32/RML-17) and three planting geometries (75cm X 25cm =53,333 plants/ha, 70cm X 25cm=57,142 plants/ ha and 60cm X 25cm= 66,666 plants/ha): Grain yield of maize was significantly affected by tillage and cropping geometry. Genotypic differences among both the released hybrid (Rampur Hybrid-2) and pre-released hybrid (RML-32/ RML-17) were not observed. The highest grain yield of 7012.18 kg/ha was harvested from NT as against 6037.59 kg/ha in CT. Similarly, planting at 65x25 cm spacing produced the highest grain yield of 7459.80 kg/ha over 75 x 25cm with 6080. 91 kg/ha.

In order to find out the appropriate doses of nitrogen for maize hybrids under conventional and conservation tillage methods, four levels of N (120, 150, 180 and 210 kg/ha) on top of the recommended doses of nitrogen (120 kg/ha) along with P (60 kg/ha) and K (40 kg/ha) an experiment had been carried out at Rampur: During winter season of 2013, grain yield in conservational tillage

(7355 kg/ha) is higher than conventional tillage (6261 kg). The highest grain yield of 8150 kg/ha was found in 210 kg N/ha applied plot and the lowest of 6632 kg/ha were recorded in 120 kg N/ha applied plot.

In a year round evaluation of maize genotypes the highest grain yield was produced from the hybrid genotype of RML-4/RML-17 (6894 kg/ha) planted in Asad and 6649kg/ha in Falgun planting followed by RML-32/RML-17 (6520 kg/ha) in Falgun and 6517 kg/ha in Bhadra planting. The ACROSS-9944/9942 produced highest grain yield 5723 kg/ha in Bhadra and S99TLYQ-B (4198 kg/ha) in Falgun planting. Comparatively lowest yields were produced by all the genotypes planted during Mangsir and Paush. The longest maturity days were found ranging from 157 to 160 days during Bhadra planting and shortest days to maturity were found ranging from 80 to 83 days of all the varieties in Chaitra planting.

In a maize and rajma intercropping trial, Rampur Composite at plant density of 53333/ha with 2 rows of rajma at 35 cm spacing produced the highest grain yield of 3555 kg/ha. Similarly Poshilo Makai-1 produced 3062 kg/ha of grain yield with 2 rows of rajma at 37.5cm spacing and Rampur Composite with 3068 kg/ha having 30 cm spacing of Rajma.

Under the maize spacing of 100 x 25cm (40000/ha), Rampur Composite produced the highest grain yield of 4407 kg /ha with 50 cm row spacing of Rajma .Similarly Poshilo Makai-1 yielded 3438 kg/ha with 50 cm row spacing of Rajma and Rampur Hybrid-2 produced the grain yield of 3407 kg/ha with 50 cm of Rajma respectively. In a trial with different tillage and genotypes, the highest grain yield in a hectare of land was found in Rampur Composite (6298 kg/ha) and RML-32/RML-17 (5980 kg/ha) under no tillage with residues kept plot followed by Rampur Composite 5845 kg/ha in conventional tillage during 2071 winter, at NMRP, Rampur. Rampur Composite and RML-32/RML-17 hybrid performed well during winter season under no tillage with residue retention in Terai region of Nepal. In the intercropping of maize and rajma, planting of Rampur Composite and rajma (RR 100 cm) or (RR 50 cm) shows 100 kg reduction of maize yield in every 15 days delay of sowing.

Soil Science

In variety cum fertilizer trial at winter season 014/15, the highest grain yield of RML32xRML17, RML4xRML17, Across 9331 and S99TLYQ-B were 6853 kg/ha, 6192 kg/ha, 4887 kg/ha and 6356 kg/ha with the application of 180:90:60NPK kg/ha recorded respectively.

In summer season 2014, genotype Arun 3 gave the highest grain yield 2534 kg/ha recorded with the application of 60 kg N/ha basal and 60 kg N/ha at 45 DAS among the tested N fertilizer timings. In summer season 2014, genotype

S99TLYQ-B gave the highest grain yield 5860 kg/ha with the basal application of 60 kg N/ha and side dressing of 60 kg N/ha at 45 days after sowing. Similarly, application of 30 kg N/ha basal and side dressing of 30 kg N each at 30, 45, and 60 DAS (5687 kg/ha) were found better practice among the tested N fertilizer timings.

In winter season 2014/015, the highest grain yield of inbred RML 32 was found with the application of 120:90:40 NPK kg/ha (1601 kg/ha) followed by the application of 180:90:40 NPK kg/ha (1396 kg/ha).Similarly,the highest grain yield of inbred RML 17 was found with the application of 150:90:40 NPK kg/ha (2687 kg/ha) followed by the application of 120:60:40 NPK kg/ha (2608 kg/ha). Similarly the highest grain yield of inbred RML 96 was found with the application of 180:90:40 NPK kg/ha (701 kg/ha). Similarly, the highest grain yield of inbred RML 95 was found with the application of 150:60:40 NPK kg/ha (844 kg/ha) and highest grain yield of inbred RML 4 was found with the application of 120:90:40 NPK kg/ha (627 kg/ha). In winter season 2014/015, updating fertilizer dose for RML 32 × RML17, there was no significant different among the treatments for all the tested parameters. The grain yield ranged from 7633kg/ha (200:60:40 NPK kg/ha) to 9327 kg/ha (160:60:60).

Plant Pathology

In Gray leaf spot disease screening nurseries, the result from Pakhribas during 2014 showed that the genotype P501SRCO/P502SRCO was recorded for resistant (1.3) reaction and three genotypes 05SADVI, Entry # 36 and Entry # 27 were responded for MR reaction. In case of Dhungkharka nine genotypes namely; ZM-401, ZM-627, 05SADVI, 07SADVI, TLBRSO7F16, ENTRY#33, ENTRY#24, ENTRY#32 and ENTRY#21 were recorded for MR reaction. The tested genotypes at Salyan revealed that six genotypes namely; 05SADVI, 07SADVI, ACROSS-9942/ACROSS-9944, BGBYPOP, ENTRY # 24 and ENTRY# 32 were reacted resistant reaction and the genotype 07SADVI produced significantly highest grain yield (8638 kg/ha).

Among the tested genotypes RML-6/RML-7 was recorded for resistant (R) reaction and other ten genotypes namely; RML-32/RML-17, RML-4/RML-17, Rampur hybrid-2, RL-4//RL-111, (RML-68/RL-101)/(RML-8/RML-62), KYM-33/KYM-35, RML-68/RL-101, (RML-174/RML-36)/(RML-6/RML-19), Rajkumar and Rampur composite responded moderately resistant (MR) reaction against ear rot disease of maize.

None of the tested genotypes reacted resistant (R) to moderately resistant (MR) but all the genotypes reacted moderately susceptible (MS) to susceptible (S) against Northern leaf blight, Southern leaf blight and Banded leaf and sheath

blight diseases from the screening nurseries conducted in different parts of the country.

Entomology

Trichogramma is one of the most effective egg parasitoids of lepidopteran pest. In order to test the effective dose of trichogramma wasp for the management of maize stem borer, *Chilo partellus*, an experiment of four doses has been completed. Yield trait attributes such as plant height, number of cobs per plant, test weight, and grain yield were recorded along with the maize stem borer damage parameters such as tunnel length and number of exit holes per plant. All the measured attributes were similar in terms of Trichogramma wasp doses.

An experiment composed of 40 elite maize genotypes were evaluated at NMRP, Rampur during 2071/72 spring season to find out the resistance source of maize stem borer, *Chilo partellus* Swinhoe (Lepidoptera: Pyralidae). Among them, Across9942/Across 9944, BGBYPOP, Arun 1 EV, OEHPW, R-POP-1, RampurSO3FQ02, Rampur S10F18, S99TLYQ-B, S00TLYQ-B, RML-32 x RML-17, RML-4 x RML-17, RML-95 x RML-96, RML-87 x RL-105, RML-86 x RML-96 were found resistant/tolerance genotypes. Similarly, (Chloropyriphos 50 EC + Cypermethrin 5 EC) @ 1.5 ml/lit, Spinosad 45% EC @ 0.5ml/lit, Furadon 3 G @ 3-4gm/whorl and Chloropyriphos 20 EC @ 1.5 ml/liter of water were found best against maize stem borer management. Among the tested botanicals and packing materials against maize storage insect pests, the use of Sweet flag rhizome powder @ 20g/kg, Neem karnel seed powder @ 10g/kg in the case of botanicals and Super grain bag, Purdue Improved Crop Storage (PICS) bag, 200 gauge plastic bag with 12% and 15% moisture level in the packing materials were observed to be very effective against them on maize for a period up to 4 months.

Outreach Research

The yields of promising pipeline maize genotypes were higher than famers' varieties. The company hybrid (Decalb double) showed little bit higher yield (10.2 t/ha) than released variety Rampur Hybrid-2 (9.5 t/ha) and three way cross hybrid maize genotype (RML-95/RML-96)/RML-17 (9.2 t/ha). Similarly, in QPM genotype; S99TLYQ-B (6.47 t/ha), SO3TLYQ-AB-02 (6.02 t/ha) showed good result, in full maize season genotypes; Upahar (6.4 t/ha), HG-A (5.8 t/ha) and Across-9331 (5.1 t/ha) were produced highest yield and in early maize genotype; EEYC-1 (5.0 t/ha) and Pool-16 E (4.5 t/ha) were identified as promising and preferred by farmers.

In rice genotypes, IR-87615-9-3-1-3 and IR-81826-B-B-5-7 produced highest yield (4.74 t/ha) and (4.43 t/ha) respectively for normal season rice, IR-64683-87-2-2-3-3 (4.74 t/ha) for early season and IR-77542-90-1-1-1-1-5 (4.06 t/

ha) and IR-77539-80-2-2-2 (3.95 t/ha) for fine and aromatic purposes showed the best performance. Similarly, in wheat genotypes BL-4316 (3.36 t/ha) and NL-1172 (3.12 t/ha) showed the best performance in terms of both yield and farmer's ranking.

Collaborative Experiments

Rice

Four experiments were received during 2071/72 and were planted at Agronomy farm of NMRP, Rampur. A total of 30 genotypes were included in CVT-Normal set and out of tested genotypes NR-2158-13-1-2-4-1 (5.1 t/ha) produced the highest grain yield followed by MTU-115 and NR-2157-144-1-3-1-1-1 (4.7 t/ha). In another set CVT-fine and aromatic set, 16 rice genotypes were evaluated and the highest yield was obtained from IR-9478-67-3-3-2 (5.0 t/ha) followed by IET-17278, IR-78006-55-2-3-3 and IR-83377-B-B-105-4 (4.4 t/ha), respectively. Similarly, in CVT-rainfed low land and early set, 26 rice genotypes were included and for grain yield production four genotypes namely; Radha-4, IR-48859-B-86-3-1, IR-80408-B-43-3 and IR-87754-42-2-2 produced more than 4 t/ha grain, respectively. During 2014/15 summer season one set of NRBN containing 330 rice genotypes were screened at Rampur. Out of the tested genotypes 46 genotypes were free from blast disease with the score of 'O' and 102 genotypes showed highly resistant against this disease with final score of '1' (0-9 score) .

Wheat

Different wheat experiments were conducted at Rampur during 2014/15 at Rampur with the collaboration with NWRP, Bhairahawa. Five experiments namely; initial evaluation trial (IET), coordinated varietal trial (CVT), wheat varietal display (WVD), Nepal rain-fed nursery (NRN) and national wheat disease screening nursery (NWDSN). For grain yield significantly highest grain yield was produced by NL-1244 (3.8 t/ha) followed by NL-1249 and NL-1254 (3.6 t/ha). CVT included 20 wheat genotypes. However for grain yield non-significant result was observed and highest grain yield was obtained from BL-4406 (3.4 t/ha) followed by BL-4407 and NL-1211 (3.3 t/ha), respectively. Wheat variety display was included 43 wheat genotypes and planted in non replicated condition and yield and yield attributing characters were recorded. Of the tested genotypes Triticale was superior for grain yield production (5.2 t/ha) and followed by Dhaulagiri (4.7 t/ha) and BL-3623 (4.6 t/ha). Nepal rainfed nursery included 100 wheat genotypes and planted in single replication. Most of the tested genotypes produced less than 1 t/ha grain yield. However, the genotype BL-3064/kiritatati/wbll-1 produced highest grain yield (2.05 t/ha) followed by PASTOR//HXN7573/2*BAU/3/WBLL-1 (2.0 t/ha). In national wheat disease screening nursery (NWDSN) 380 wheat genotypes were included and planted

in rod row methods. For leaf blight disease among the tested genotypes, only 14 genotypes were found resistant to moderately resistant.

Source Seed Production

A total of 51.813 tons of maize seed was produced. In case of Rampur Composite, 1481 kg breeder seed, 15,808 kg foundation seed and 3,930 kg improved seed was produced. In case of Arun-2, 700 kg breeder seed, 7,100 kg foundation seed and 5825 kg improved seed was produced. Similarly, in case of Manakamana-3, 1149 kg breeder seed, 7626 kg foundation seed and 5339 kg improved seed was produced. In case of Deuti, 150 kg breeder seed, 2275 kg foundation seed and 50 kg improved seed was produced. In case of Poshilo Makai-1, 110 kg breeder seed and 270 kg foundation seed was produced. Foundation seed production in rice, wheat and sun hemp was 24,231 kg, 4,072 kg and 1050 kg respectively.

Special Projects

1. Agriculture and Food Security Project (AFSP)

Three groups of pipeline maize varieties were maintained and produced 400 kg breeder seed and 4000 kg foundation seed in station. 1210 kg of Breeder Seed and 2760 kg of foundation seed was distributed in cost to the districts of AFSP command area. Two days maize seed production training to the two CBSP groups each of Agriculture Research Station (ARS), Surkhet and Ginger Research Program (GRP), Salyan was conducted.

2. Kisan ka lagi Unnat Biu bijan Karyakram (KUBK)

Foundation seed production program in two CBSP groups, one in each Gulmi and Arghakhachi district were conducted. In Gulmi, Rampur Composite and Manakamana-3 in 9 ha and 8 ha respectively in Arghakhachi, Rampur Composite in 10 ha. Agricultural inputs breeder seed, urea, insecticide, seed bins, tarpaulins, jute bags (with CBSP logo), jute bag sewing machine, digital weighing balance and maize seller were provided in free of cost to both of the CBSP groups. Beside these, two days training was organized about maize seed production and PVS techniques to both of the CBSP.

1. WORKING CONTEXT

Introduction

The National Maize Research Program (NMRP) was evolved as a part of the Rapti Valley Development Project (RVDP) in the year 2013 B.S. (1956 AD) with a view to rehabilitate the flood victims of 2011 B.S. (1954 AD) and to test, develop and recommend a package of farming system technologies to newly settled farmers. However, the systematic research activities were initiated from the year 2020 B.S. (1963). With the inception of commodity research program in 2029 B.S. (1972 AD), this office was mandated for the research and development of maize and maize based cropping system. After the establishment of Nepal Agricultural Research Council (NARC) in 2048 B.S. (1991 AD), this station was renamed as the National Maize Research Program (NMRP) and mandated to develop appropriate maize and maize based technologies for various agro-ecological zones of the country. NMRP, Rampur is located about 10 km west of Bharatpur, the district headquarter of Chitwan, in inner terai (Siwalik Dun Valley) region of Nepal. The geographical location is 27° 40'N latitude, 84° 19' E longitude at an altitude of 228 meter above sea level.

Goal

Increase production and productivity of maize and maize based cropping system in sustainable manner for improving national food, feed and nutritional security.

Objectives

- To collect, characterize, utilize and conserve different local and e×otic maize germplasms.
- To develop high yielding, disease and insect resistant early, e×tra early and full season OPVs of maize suitable for different agro-environments
- To develop high yielding disease and insect tolerant single cross, double cross and top cross hybrids for terai and foot hill valleys
- To undertake basic, applied and adaptive research work on maize and maize based cropping system
- To conduct different outreach research activities on maize based cropping system in three districts Chitwan, Makawanpur and Nawalparasi with active participation of related stakeholders.
- To develop/test different agriculture implements/machineries in order to increase maize production with reduced cost and drudgery.
- To generate maize based conservation agriculture technologies for improving soil health/fertility and increasing maize productivity in a sustainable manner.

- To work as national institute for research, training and education in maize and maize based cropping system.
- To work as repository of information on maize and maize based technologies.
- To disseminate maize and maize based technologies to the different stakeholders through electronic media, booklets, folders, leaflets and posters
- To establish and strengthen national and international linkages for e×change of knowledge, research materials and collaborative research works
- To produce source seeds of maize (BS, FS), rice and wheat (FS) and distribute to different clients according to their demands (balance sheet of NSB)
- To publish research findings, recommend verified technologies and collaborate with disseminating partners for its wider dissemination

Geography and climate

The geographical location of National Maize Research Program (NMRP), Rampur, Chitwan is 27˚40' N latitude, 84˚19' E longitude at an altitude of 228 meter above sea level. It has humid and subtropical climate with cool winter and hot summer. The soil is generally acidic (pH 4.6-5.7), light textured and sandy loam. The average total annual rainfall of 14 years (2000-2014 AD) was 2210.35 mm with a distinct monsoon period (>75% of annual rainfall) from mid-June to mid-September. The command area covers Chitwan and Siwalik valley of Nawalparasi and Makawanpur districts. The main objective of outreach research is to reduce the yield gap between on-station and on-farm in maize.

2. RESEARCH HIGHLIGHT

2.1 Plant Breeding

2.1.1 Hybrid Maize Research and Development 2014/15

Different inbred and hybrid experiments were conducted across the terai and hill stations. Hybrid experiments included both NMRP developed and hybrids received from Global Maize Program and Heat Tolerant Maize for Asia project under CIMMYT, Hyderabad. NMRP developed hybrids were evaluated under observation nursery (OBN), test crosses (TC), double cross hybrids, coordinated hybrid trials (CHT) and coordinated farmer's field trials (CFFT) in terai regions and in hills CHT and CFFT were conducted. At Rampur a total of 244 fixed inbred lines were planted for per se performance and for finding heterotic partners each other by crossing. Out of all tested inbred some outstanding for per se performance and good for combining ability were RML-5, RML-8, RL-105, RL-197, RL-180, RML-62, RML-68, RML-36, NML-1, RML-4, RL-176, RML-76, RML-57, RL-174, RML-17, RML-32, RML-4, RML-83, RML-84, RML-85, RML-86, RML-95, RML-96, RML-98, RML-117, RML-19 and RML-120. The tester RL-105 was crossed with 20 inbred and produced more than 9 t/ha by only si× hybrids namely; RML-40/RL-105, RML-37/RL-105, RL-35A/RL-105, RML-25/RL-105, RML-115/RL-105 and RL-29/RML-105. Another tester was taken RML-140 and was made 8 crosses and two hybrids RML-13/RML-140 and RML-8/RML-140 produced more than 8 t/ha grain yield. Another test cross was conducted with the use of the tester RML-96 and was made 59 crosses. Out of the tested hybrids, 19 hybrids produced more than 7 t/ha grain yield and the highest grain yield was obtained from RL-30-1/RML-96 (10 t/ha). Another experiment at Rampur was conducted as observation nursery (OBN) on early test hybrids including 62 single crosses with two checks. Most of the hybrids yielded lowest grain yield however 6 test hybrids and one standard check (Rampur Hybrid-2) produced more than 7 t/ha grain yield and the highest grain was recorded from RML-129/RML-124 (9 t/ha). In coordinated hybrid trial tested at Rampur the highest grain yield was recorded in RML-5/RL-105 (8.1 t/ha) followed by RML-98/RL-105 (8.0 t/ha) and RML-95/RL-105 and RML-85/RL-105 (7.6 t/ha). Again at Rampur, 35 double crosses, 5 three way crosses with two checks were evaluated and for grain yield production (RML-8/RML-62)/(RML-4/RML-17) was recorded for superior (8.1 t/ha) followed by (RML-4/NML-2)/(RML-6/RML-19) (7.9 t/ha) and (RML-8/RML-6)/RML-95/RML-96) (7.8 t/ha), respectively. At Belachapi three different sets of experiments namely; observation nursery (OBN), coordinated hybrid trial (CHT) and coordinated farmer's field trials (CFFTH) were conducted. From the result of OBN, the grain yield ranged from 3.o t/ha (RML-121/RML-119) to 10.8 t/ha (RML-130/RML-125) among the tested entries. From the result of CHT at this location except plant height all other

recorded traits were non-significant among the tested Genotype. However, the grain yield ranged from 5.9 t/ha (RML-4/RL-111, RL-151/RL-111) to 11.0 t/ha (RL-180/RL-105), respectively. One set of CFFTH was evaluated and the highest grain yield was obtained from RML-86/RML-96 (8.2 t/ha) followed by RML-95/RML-96 (5.4 t/ha). From the result of hills over three locations Khumal Hybrid-2, JM-8, RML-32/RML-17 & RL-153/RL-105 performed better & produced highest grain yield as compared to other tested hybrids. From the result of Coordinated farmer's field trials (CFFT) Khumal hybrid-2 performed better over the locations. From CIMMYT hybrids the outstanding for grain yield and other agronomic traits were RML-32/RIVS3, CAHCH144S3, CAHCH140S3 and CAHCH142S3.

Introduction

Maize (*Zea mays* L.) is second staple food crop of Nepal and the principal food, feed, fodder, fuel crop and source of energy in hills. It is widely grown in all the three agro zones of Nepal: Terai and Inner Terai (below 900 msl), the mid hills (900-1800 msl) and high hills (above 1800 msl). Hybrid maize technology has made significant yield advances and increased profitability and to some e×tent provided employment opportunity. There is lack of locally developed hybrid varieties in Nepal. National Maize Research Program has so far released two single cross hybrids namely "Gaurav" and Rampur Hybrid-2 but Gaurav could not reach in farmer's field due to some technical problems and Rampur hybrid-2 is being taken by some seed companies. Farmers have been demanding F_1 hybrid seeds and a number of multinational hybrid varieties are being marketed every year across the Terai & Inner Terai regions of Nepal and they are being cheated every year by local dealers of multi-national hybrid seed companies based in India while purchasing hybrid seeds due to open boarder. National Maize Research Program (NMRP) has been conducting research activities to develop locally adapted, disease resistant and high-yielding maize hybrids. A number of hybrids were evaluated in a series of experiments during 2014/15 across the hill and terai environments of Nepal. The objective of the study was to develop and identify high yielding hybrids for terai and hills of Nepal.

Materials and Methods

The details of hybrid experiments were as follows;

Table 1. List of NMRP developed hybrid maize experiments conducted during 2014/15

S. No.	Experiment	Location	No of entry
1.	Fixed Inbred evaluation	Rampur	244
2.	Hybrid observation nursery	Rampur	62
3.	Hybrid observation nursery	Belachapi	42
4.	Coordinated hybrid Trial (CVTH)	Rampur, Belachhapi, Tarahara, Parwanipur	25
5.	Test cross hybrid-1	Rampur	35
6.	Test cross hybrid-2	Rampur	66
7.	Double cross hybrid	Rampur, Parwanipur	42
8.	CFFT	Rampur, Belachapi, Tarahara, Parwanipur	8
9.	Coordinated hybrid Trial (CVTH)	Khumaltar, Pakhribas, Kabre	20
10.	CFFTH	Khumaltar, Pakhribas, Kabre	7

Results from Terai and inner terai

Different inbred and hybrid experiments were conducted across the terai environments of Nepal during 2014/15 winter season. At Rampur a total of 244 fixed inbred lines were planted for *per se* performance and for finding heterotic partners each other by crossing. Out of all tested inbred some outstanding for *per se* performance and good for combining ability were RML-5, RML-8, RL-105, RL-197, RL-180, RML-62, RML-68, RML-36, NML-1, RML-4, RL-176, RML-76, RML-57, RL-174, RML-17, RML-32, RML-4, RML-83, RML-84, RML-85, RML-86, RML-95, RML-96, RML-98, RML-117, RML-19 and RML-120. Some other lines also being generated and now in S5-S6 and will be identified their combining ability in next cycle of planting. Other hybrid experiments conducted at Rampur were Test cross-1, Test cross-2, Observation nursery, Double cross and Coordinated hybrid trial, respectively. In test cross-1, two testers namely; RL-105 and RML-140 and in test croos-2 RML-96 was used as testers for finding heterosis and combining ability among the tested inbred. The tester RL-105 was crossed with 20 inbred and produced more than 9 t/ha by only six hybrids namely; RML-40/RL-105, RML-37/RL-105, RL-35A/RL-105, RML-25/RL-105, RML-115/RL-105 and RL-29/RML-105. Another tester was taken RML-140 and was made 8 crosses and two hybrids RML-13/RML-140 and RML-8/RML-140 produced more than 8 t/ha grain yield among the crosses and these all parents of the selected hybrids have been selected for ne×t year crossing for other yield trials. Another test cross was conducted with the use of the tester RML-96 and was made 59 crosses. Out of the tested hybrids, 19 hybrids produced more than 7 t/ha grain yield and the highest grain yield

was obtained from RL-30-1/RML-96 (10 t/ha). Other details of yield attributing characters have been presented in Table-2. Another experiment at Rampur was conducted as observation nursery (OBN) on early test hybrids including 62 single crosses with two checks. Most of the hybrids yielded lowest grain yield however 6 test hybrids and one standard check (Rampur Hybrid-2) produced more than 7 t/ha grain yield and the highest grain was recorded from RML-129/ RML-124 (9 t/ha). Details of the other traits have been presented in Table-3. In coordinated hybrid trial tested at Rampur significant differences were observed on anthesis, silking and plant height and non significant results were found in grain yield, ear height and plant height (Table-4). However, the highest grain yield was recorded in RML-5/RL-105 (8.1 t/ha) followed by RML-98/RL-105 (8.0 t/ha) and RML-95/RL-105 and RML-85/RL-105 (7.6 t/ha), respectively. Again at Rampur, 35 double crosses, 5 three way crosses with two checks were evaluated and the result revealed that only *E.tur* was found significantly differences and all other traits were non-significant (Table-4). However for grain yield production (RML-8/RML-62)/(RML-4/RML-17) was recorded for superior (8.1 t/ha) followed by (RML-4/NML-2)/(RML-6/RML-19) (7.9 t/ha) and (RML-8/RML-6)/RML-95/RML-96) (7.8 t/ha), respectively.

Table 2. Mean yield and other characters of Test cross hybrid-1 at NMRP Rampur

S.N.	Genotype	50%		Ht. in cm		E.tur. (1-5)	GY t/ ha
		anthesis	silking	Pht	Eht		
1	RML-93/RL-105	70	73	175	80	2.3	7.6
2	RML-114/RL-105	72	75	125	50	1.5	10.4
3	RML-40/RL-105	71	74	145	80	1.8	6.2
4	RML-139/RL-105	73	77	160	75	2.3	6.0
5	RL-57/RL-105	73	76	145	60	1.5	8.6
6	RML-107/RL-105	71	74	140	73	1.8	6.8
7	RML-37/RL-105	70	74	143	65	1.5	10.1
8	RL-21-1/RL-105	72	75	155	70	2.0	3.2
9	RL-35A/RL-105	70	73	165	80	1.8	9.0
10	RML-57/RL-105	71	75	115	40	1.5	6.4
11	RML-25/RL-105	68	71	145	70	2.3	10.5
12	RML-36/RL-105	72	76	150	60	1.8	6.7
13	RML-35/RL-105	71	74	185	80	2.0	7.9
14	RML-115/RL-105	70	73	140	60	1.8	10.5
15	RML-37/RL-105	76	79	140	50	1.8	9.4
16	RML-46/RL-105	70	74	145	70	2.5	5.9
17	RL-29/RL-105	71	74	155	80	2.3	9.5

S.N.	Genotype	50%		Ht. in cm		E.tur. (1-5)	GY t/ ha
		anthesis	silking	Pht	Eht		
18	RML-11/RL-105	73	76	115	45	1.5	6.8
19	RML-94/RL-105	73	76	160	90	1.8	7.1
20	RML-37/RL-105	68	72	165	95	2.0	5.3
21	RML-13/RML-140	71	74	145	60	2.0	9.1
22	RML-35/RML-140	69	72	180	95	2.8	4.7
23	RML-5/RML-140	69	73	185	95	1.5	5.7
24	RML-7/RML-140	69	73	160	75	3.3	3.8
25	RML-46/RML-140	68	72	175	63	1.5	4.9
26	RML-25/RML-140	72	74	175	85	2.0	5.5
27	RML-8/RML-140	71	74	140	70	1.5	8.1
28	RML-4/RML-140	69	72	155	65	2.3	4.6
29	(RAMPUR HYBRID)×RML-17	70	74	145	70	2.3	5.3
30	(RML-4/RML-17)×RML-17	70	74	125	60	1.8	6.0
31	RML-32/RML-17)×RML-17	70	74	145	75	2.0	4.9
32	(RML-95/RML-97)×RML-17	71	74	165	80	2.5	4.7
33	(RML-86/RML-96)×RML-17	70	72	175	85	2.3	6.4
34	Rampur Hybrid-2	72	76	145	60	2.0	3.3
35	Rajkumar	71	74	125	55	1.5	10.8
	Mean	71	74	152	70	2	6.9
	F-test	**	**	**	*	**	**
	CV%	1.9	1.7	10.6	19.5	17.7	29.3
	$LSD_{0.05}$	2.8	2.6	328	17.9	0.7	4.1

Table 3. Mean yield and other characters of Test cross hybrid-2 at NMRP Rampur

S. N.	Genotype	50%		Ht. in cm		GY t/ha	E. tur (1-5)
		anthesis	silking	PHT	EHT		
1	RML-4/RML-96	74	74	150	75	6.6	2.0
2	KYM-35/RL-101	71	74	155	80	7.9	1.8
3	RML-92/RML-96	71	74	170	80	6.5	2.8
4	RL-129/RML-96	69	72	140	90	9.3	2.0
5	RML-194/RML-96	70	73	140	80	7.8	2.0
6	RML-77/RML-96	71	74	113	53	7.2	2.3
7	RML-46/RML-96	68	71	130	50	5.4	3.5
8	RML-97/RML-96	70	73	140	75	6.2	2.3
9	RL-170/RML-196	70	73	165	70	6.3	2.8
10	RML-108/RML-96	69	74	138	63	3.7	2.3
11	RML-86/RML-96	73	76	115	45	7.9	2.3
12	RML-64/RML-96	68	71	198	105	7.0	2.0
13	RL-177/RML-96	71	75	150	85	7.9	2.8
14	RML-100/RML-96	69	72	150	80	5.8	3.0
15	RL-30-3/RML-96	70	74	145	75	7.1	2.5
16	RL-111/RML-96	69	72	140	75	6.0	3.0
17	RML-102/RML-96	70	73	140	70	9.6	2.3
18	RL-21-1/RML-96	72	75	150	80	6.7	0.8
19	RL-107/RML-96	73	76	185	85	6.0	2.3
20	RML100/RML-96	71	74	145	80	5.2	2.5
21	RML87/RML-96	70	73	165	65	6.9	2.3
22	RML-107/RML-96	74	78	95	45	4.3	1.5
23	RML-98/RML-96	70	74	140	70	6.7	1.5
24	RL-13-2/RML-96	71	73	150	95	8.4	1.8
25	RML-25/RML-96	72	75	150	65	5.7	3.0
26	RML-130/RML-96	70	73	118	65	5.2	1.5
27	RL-84/RML-96	69	73	120	60	7.2	3.0
28	RML-52/RML-96	73	72	190	95	6.6	2.8
29	RML-84/RML-96	72	75	125	40	5.3	2.5
30	RL-84/RML-96	71	74	135	65	5.1	2.3
31	RL-46/RML-96	73	76	165	100	7.0	2.0
32	NML-1/RML-96	71	74	159	91	6.1	2.3
33	RL-30-1/RML-96	70	72	155	85	10.0	2.0
34	RML-97/RML-96	70	74	145	80	5.4	2.5
35	KYM-35/RML-96	72	75	160	85	4.5	2.5

S. N.	Genotype	50%		Ht. in cm		GY t/ha	E. tur (1-5)
		anthesis	silking	PHT	EHT		
36	RML-65/RML-96	70	73	158	65	7.0	1.5
37	RML-35/RML-96	71	74	150	75	8.0	1.8
38	RML-7/RML-96	70	73	155	70	5.7	2.5
39	RML-88/RML-96	70	74	145	65	6.3	1.8
40	RML-97/RML-96	71	74	195	88	7.6	2.3
41	RL-35A/RML-96	70	73	145	70	6.8	1.8
42	RML-114/RML-96	70	73	130	55	8.9	1.8
43	RML-20/RML-96	70	73	140	65	6.9	2.8
44	RML-37/RML-96	68	72	110	50	4.1	2.0
45	RML-11/RML-96	69	72	135	55	4.0	2.8
46	RL-105/RML-96	71	73	165	70	7.2	2.3
47	RL-108/RML-96	69	73	158	80	4.0	3.0
48	RL-211/RML-96	71	77	110	65	3.4	1.5
49	RML-8/RML-96	70	73	130	70	5.4	2.3
50	RL-51/RML-96	71	74	145	80	5.7	2.0
51	RML-36/RML-96	74	73	170	90	6.7	1.8
52	RL-30-2/RML-96	71	73	100	45	6.2	2.0
53	RL-17/RML-96	74	77	135	55	4.8	2.0
54	RML-7/RML-96	70	72	135	60	3.3	3.0
55	RL-13/RML-96	72	75	140	70	8.1	1.5
56	RL-150/RML-96	69	73	100	29	7.0	2.8
57	RL-57/RML-96	69	72	125	65	3.8	2.3
58	RL-171/RML-96	71	74	120	48	3.5	1.8
59	RML-57/RML-96	70	73	115	45	6.6	2.8
60	(RAMPUR HYBRID)×RML-17	68	71	165	70	7.5	2.3
61	(RML-4/RML-17)×RML-17	71	74	135	70	6.7	2.3
62	RML-32/RML-17)×RML-17	71	74	130	55	5.9	1.8
63	(RML-95/RML-97)×RML-17	72	75	160	75	5.9	2.0
64	(RML-86/RML-96)×RML-17	68	71	120	70	6.1	1.5
65	Rampur Hybrid-2	69	72	143	70	5.3	2.0
66	Rajkumar	70	73	115	40	7.7	1.8
	Mean	70	73	143	69	6.3	2.2
	F-test	ns	ns	ns	*	ns	**
	CV%	3.2	2.9	18.6	25	34	20.9
	$LSD_{0.05}$	4.5	4	53	35	5.5	0.9

Table 4. Mean yield and other characters of single cross hybrids in Observation nursery at NMRP Rampur

S. N.	Genotype	50%		Ht. in cm		GY t/ha	E. tur (1-5)
		anthesis	silking	PHT	EHT		
1	RML-130/RML-120	73	77	125	58	4.9	2.5
2	RML-121/RML-119	71	75	130	65	5.0	2.3
3	RML-134/RML-118	72	75	135	60	4.8	2.3
4	RML-130/RML-127	76	80	148	63	4.4	2.5
5	RML-134/RML-130	71	75	143	75	4.9	2.5
6	RML-131/RML-121	72	75	123	58	5.9	2.3
7	RML-129/RML-121	70	73	148	63	5.0	2.3
8	RML-13/RML-124	71	74	140	75	3.7	2.5
9	RML-13/RML-118	69	73	170	93	5.0	2.8
10	RML-120/RML-118	74	78	150	75	5.1	1.5
11	RML-134/RML-121	71	74	110	45	5.0	2.3
12	RML-130/RML-121	72	75	155	85	5.4	2.3
13	RML-127/RML-121	71	74	145	65	5.3	3.0
14	RML-124/RML-118	71	74	173	85	6.6	2.0
15	RML-129/RML-124	70	73	120	65	6.8	1.8
16	RML-126/RML-122	73	76	158	90	6.6	2.0
17	RML-131/RML-120	71	74	135	65	4.9	2.5
18	RML-133/RML-120	74	78	135	65	5.9	2.0
19	RML-131/RML-127	74	78	163	83	7.9	1.8
20	RML-130/RML-129	72	76	158	63	5.9	2.0
21	RML-131/RML-118	71	74	180	90	3.2	2.0
22	RML-129/RML-118	73	76	145	65	3.9	1.8
23	RML-133/RML-129	73	76	190	110	2.9	0.8
24	RML-127/RML-121	71	75	120	60	4.8	2.0
25	RML-133/RML-124	72	76	155	85	5.2	2.0
26	RML-134/RML-125	72	75	95	40	8.7	2.5
27	RML-127/RML-119	71	74	165	75	3.7	1.8
28	RML-134/RML-124	71	74	165	68	6.5	2.5
29	RML-134/RML-127	70	73	110	53	4.8	2.5
30	RML-133/RML-118	72	75	140	75	5.9	2.5
31	RML-120/RML-119	71	74	170	100	6.3	2.0
32	RML-126/RML-123	72	75	173	78	5.7	2.5
33	RML-134/RML-120	74	77	130	65	7.3	1.8
34	RML-128/RML-123	75	79	180	85	4.7	2.3

S. N.	Genotype	50%		Ht. in cm		GY t/ha	E. tur (1-5)
		anthesis	silking	PHT	EHT		
35	RML-133/RML-121	70	74	140	73	5.0	2.8
36	RML-132/RML-122	65	72	95	50	2.5	2.1
37	RML-127/RML-124	73	76	105	53	3.5	2.8
38	RML-130/RML-127	72	76	160	75	4.2	2.3
39	RML-129/RML-124	72	76	168	80	9.0	2.8
40	RML-128/RML-126	75	79	115	55	3.5	1.8
41	RML-127/RML-125	74	77	108	58	1.8	3.0
42	RML-129/RML-120	68	72	95	45	5.8	1.8
43	RML-129/RML-119	70	73	135	65	3.1	2.3
44	RML-132/RML-126	74	77	190	110	4.8	1.8
45	RML-132/RML-128	74	79	158	68	7.8	2.3
46	RML-131/RML-125	73	77	190	105	3.9	2.5
47	RML-119/RML-118	71	75	170	75	2.7	2.5
48	RML-127/RML-118	74	78	128	60	6.4	2.5
49	RML-130/RML-125	69	73	155	65	4.3	2.3
50	RML-128/RML-122	73	77	170	80	8.2	2.3
51	RML-118/RML-125	72	76	173	78	4.1	2.0
52	RML-130/RML-118	74	77	118	53	7.8	2.0
53	RML-123/RML-122	73	76	155	75	5.2	1.8
54	RML-124/RML-119	71	74	165	85	3.8	2.5
55	RML-132/RML-123	76	80	148	68	5.5	1.8
56	(RAMPUR HYBRID)×RML-17	73	76	145	70	4.6	2.0
57	(RML-4/RML-17)×RML-17	71	74	140	55	4.3	2.3
58	RML-32/RML-17)×RML-17	72	75	155	75	7.1	2.0
59	(RML-95/RML-97)×RML-17	72	75	133	63	3.7	1.8
60	(RML-86/RML-96)×RML-17	73	76	130	63	6.8	2.5
61	Rampur Hybrid-2	73	77	198	90	7.6	2.3
62	Rajkumar	71	75	170	93	6.1	1.8
	Mean	72	75	147	71	5.2	2.2
	F-test	**	**	ns	ns	ns	ns
	CV%	2.5	2.5	20	30.9	31.2	28.8
	$LSD_{0.05}$	3.5	3.8	59	44	3.8	1.3

Table 5. Mean yield and other characters of single cross hybrids In Coordinated hybrid trial at NMRP, Rampur

S. N.	Genotype	GY t/ha	50%		Ht, in cm		E. tur
			anthesis	silking	Pht	Eht	
1	RML-87/RL-105	7.1	68	73	163	82	1.8
2	RML-95/RL-105	7.6	67	71	177	92	1.7
3	RML-83/RL-197	4.6	66	70	152	73	2.0
4	RML-19/NML-2	7.2	68	72	168	77	1.7
5	RML-68/RL101	5.4	65	70	142	68	2.2
6	RL-21/RL-101	6.2	63	67	172	77	2.3
7	RL-36/RL-197	6.1	67	72	198	72	1.5
8	RL-125/RML-18	7.0	66	66	150	60	1.8
9	RML-4/RL-111	7.5	65	70	153	75	1.7
10	RL-151/RL111	6.1	65	70	188	85	2.0
11	RL-150/RL-111	6.9	63	67	192	87	1.8
12	RML-98/RL-105	8.0	68	73	140	78	1.5
13	RML-5/RL-105	8.1	68	72	175	75	1.2
14	RL-180/RL-105	7.3	66	69	170	72	1.5
15	RML-55/RL-105	6.2	67	71	220	117	2.0
16	RML-85/RL-105	7.6	68	72	153	82	2.2
17	RML-57/RL-105	7.3	66	70	187	77	1.7
18	(RAMPUR HYBRID)/ RML-17	6.7	66	70	172	75	1.8
19	(RML-4/RML-17)/RML-17	5.0	69	73	157	73	1.8
20	RML-32/RML-17)/RML-17	5.9	66	71	158	67	2.2
21	(RML-95/RML-97)/RML-17	7.2	67	71	163	70	2.2
22	(RML-86/RML-96)/RML-17	5.9	67	71	173	77	2.0
23	RML-32/RML-17	5.7	64	68	173	70	1.8
24	RML-4/RML-17	5.3	70	74	145	70	1.8
25	Rajkumar	7.5	66	70	155	68	2.0
	Mean	6.6	66	70	168	77	1.8
	F-test	ns	*	**	**	ns	Ns
	CV%	22.3	3	3.2	13.3	18.8	21.1
	$LSD_{0.05}$	2.4	3.3	3.7	37	24	0.64

Table 6. Mean yield and other characters of Double cross hybrid at NMRP Rampur

S. N.	Genotype	50%		Ht. in cm		E.tur (1-5)	GY t/ha
		anthesis	silking	PHT	EHT		
1	(RML-8/RML-62)/(RML-84/RL-105)	74	78	150	65	1.8	7.1
2	(RML-109/RML-140)/(RML-32/RL-105)	70	73	125	60	2.0	6.2
3	(RML-8/RML-62)/(RML-32/RML-17)	72	75	180	90	1.8	7.6
4	(RML-109/RML-140)/(RML-4/RML17)	73	76	155	75	2.3	5.6
5	(RML151/RL-111)/(RML-4/RML-17)	70	73	165	80	2.0	5.9
6	(RML-32/RML-17)/(RML-6/RML-19)	70	73	140	65	2.0	6.7
7	(RML-109/RML-140)/(RML-6/RML-19)	72	75	110	50	2.0	4.3
8	(RML-109/RML-140)/(RML-84/RL-105)	72	75	165	90	2.5	5.7
9	(RML-151/RL-111)/(RML-109/RML-140)	70	75	180	95	3.0	4.7
10	(RML-32/RML-17)/(RML-4/NML-2)	74	77	140	60	1.5	5.8
11	(RML-8/RML-62)/(RML-4/RML-17)	72	74	180	90	1.8	8.1
12	(RML-8/RML-62)/(RML-4/NML-2)	72	75	145	70	1.3	7.4
13	(RML-84/RL-105)/(RML-32/RML-17)	73	76	150	65	2.5	6.0
14	(RL-105/RL-111)/(RML-4/NML-2)	72	74	170	90	2.0	4.9
15	(RML-95/RML-96)/(RML-32/RML-17)	72	75	120	60	2.3	5.8
16	(RML-6/RML-19)/(RML-84/RL-105)	72	75	155	70	2.3	6.0
17	(RML-95/RML-96)/(RML-32/RML-17)	71	74	125	45	2.8	4.5
18	(RML-95/RML-96)/(RML-6RML-19)	71	74	165	80	2.5	7.4
19	(RML-109/RML-140))/(RML-95/RML-96)	71	74	115	60	1.8	5.5
20	(RML-109/RML-140)/(RML-4/NML-2)	71	75	160	70	2.2	7.6
21	(RML-95/RML-96)/(RML-4/RML-17)	73	76	120	60	2.5	4.5
22	(RL-151/RL-111)/(RML-84/RL-105)	72	75	130	60	3.5	5.6
23	(RML-109/RML-140)/(RML-32/RML-17)	70	73	170	85	2.3	5.7
24	(RML-8/RML-62)/(RML-95/RML-96)	70	74	165	75	2.3	7.8
25	(RML-95/RML-96/)/(RML-4/NML-2)	70	74	125	60	1.5	6.6
26	(RML-95/RML-96)/(RML-84/RL-105)	74	77	155	75	2.3	4.5
27	(RML-109/RML-140)/(RML-8/RML-62)	72	75	145	75	1.8	4.4
28	(RML-109/RML-140)/(RML-8/RML-19)	73	77	160	75	1.5	4.5
29	(RL-151/RL-111)/(RML-32/RML-17)	72	75	125	40	1.8	4.1
30	(RML-84/RML-105)/(RML-6/RML-19)	71	75	155	75	2.8	6.6
31	(RML-95/RML-96)/(RML-4/NML-2)	70	74	130	70	2.3	6.0
32	(RML-4/RML-2)/(RML-6/RML-19)	72	75	155	90	1.8	7.9
33	(RL-151/RL-111)/(RML-6/RML-19)	72	75	155	75	2.3	4.4
34	(RML-95/RML-96)/(RML-4/NML-2)	71	73	155	90	1.8	5.7

S. N.	Genotype	50%		Ht. in cm		E.tur (1-5)	GY t/ha
		anthesis	silking	PHT	EHT		
35	(RL-151/RL-111)/(RML-95/RML-96)	72	76	150	75	3.0	3.4
36	(RAMPUR HYBRID)×RML-17	75	78	125	45	2.5	5.5
37	(RML-4/RML-17)×RML-17	72	76	150	75	2.3	7.4
38	RML-32/RML-17)×RML-17	74	77	115	55	2.3	4.8
39	(RML-95/RML-97)×RML-17	72	75	125	55	1.8	5.6
40	(RML-86/RML-96)×RML-17	69	73	170	90	2.0	6.8
41	Rampur Hybrid-2	73	76	130	80	2.3	6.1
42	Rajkumar	71	74	95	35	2.0	4.3
	Mean	71	75	145	70	2.1	5.8
	F-test	ns	ns	ns	ns	*	Ns
	CV%	2.1	2.2	17	25.3	22.7	27.6
	$LSD_{0.05}$	3	3.3	50	35.9	0.9	3.2

At Belachapi three different sets of experiments namely; observation nursery (OBN), coordinated hybrid trial (CHT) and coordinated farmer's field trials (CFFTH) were conducted. From the result of OBN, exept plant height and ear aspect all other traits were significantly difference. The grain yield ranged from 3.o t/ha (RML-121/RML-119) to 10.8 t/ha (RML-130/RML-125) among the tested entries (Table-7). From the result of CHT at this location except plant height all other recorded traits were non significant among the tested Genotype. However, the grain yield ranged from 5.9 t/ha (RML-4/RL-111, RL-151/RL-111) to 11.0 t/ha (RL-180/RL-105), respectively (Table-7). One set of CFFTH was evaluated and the highest grain yield was obtained from RML-86/RML-96 (8.2 t/ha) followed by RML-95/RML-96 (5.4 t/ha) (Table-8).

Table 7. Mean yield and other characters of observation nursery in single cross hybrid at Belachapi

S. N.	Genotype	50%		Ht. in cm		Aspects (1-5)			GY t/ha
		anthesis	silking	PHT	EHT	PA	EA	HC	
1	RML-123/RML-122	80	83	196	72	2.5	2.0	2.3	8.0
2	RML-128/RML-122	77	80	228	100	2.3	2.3	1.8	9.0
3	RML-119/RML-118	76	78	198	73	3.3	2.3	3.5	7.7
4	RML-127/RML-118	76	79	208	76	2.0	2.3	1.3	8.2
5	RML-118/RML-125	80	83	219	86	1.5	1.3	1.5	7.5
6	RML-132/RML-123	76	79	223	75	2.0	1.5	1.0	9.8
7	RML-131/RML-125	76	79	194	63	2.0	2.3	1.5	8.9
8	RML-132/RML-128	76	80	213	88	2.3	1.8	1.3	7.9
9	RML-130/RML-125	74	76	229	93	2.5	1.8	1.3	10.8

S. N.	Genotype	50%		Ht. in cm		Aspects (1-5)			GY t/ha
		anthesis	silking	PHT	EHT	PA	EA	HC	
10	RML-130/RML-118	75	78	214	94	2.0	2.0	2.3	7.8
11	RML-132/RML-126	74	78	202	89	2.5	2.3	2.5	6.1
12	RML-124/RML-119	73	75	211	64	2.5	2.3	2.3	5.1
13	RML-131/RML-127	75	78	190	58	3.0	2.8	2.0	8.6
14	RML-121/RML-119	74	78	179	72	2.5	2.3	1.5	3.0
15	RML-131/RML-120	76	79	215	83	2.8	2.8	3.0	8.6
16	RML-126/RML-122	78	80	189	79	2.3	2.5	1.3	8.5
17	RML-131/RML-129	79	82	212	74	3.0	2.8	1.0	5.2
18	RML-128/RML-123	74	77	217	86	2.0	3.0	1.0	6.5
19	RML-131/RML-129	73	76	170	48	2.5	2.0	1.0	4.8
20	RML-134/RML-125	75	78	192	67	3.3	3.0	2.5	6.5
21	RML-124/RML-118	76	79	234	100	2.0	2.0	2.5	4.2
22	RML-134/RML-125	76	79	198	60	2.8	2.5	1.0	8.4
23	RML-127/RML-119	80	83	192	76	2.8	2.5	1.5	5.2
24	RML-128/RML-126	76	79	205	75	2.5	2.0	1.5	6.5
25	RML-127/RML-125	76	79	145	58	4.0	4.0	3.0	3.5
26	RML-134/RML-127	76	79	218	90	1.8	1.8	2.8	9.5
27	RML-131/RML-121	78	81	194	79	2.3	1.8	1.8	5.6
28	RML-134/RML-130	78	80	196	63	2.3	2.0	1.3	7.5
29	RML-131/RML-124	74	76	177	64	2.5	2.0	2.3	8.6
30	RML-133/RML-124	75	77	109	47	2.5	2.3	2.8	5.8
31	RML-120/RML-118	75	78	210	83	3.5	2.5	1.5	8.3
32	RML-130/RML-127	76	79	230	94	1.5	1.5	1.0	6.6
33	RML-129/RML-118	78	81	202	74	2.3	2.5	2.3	6.5
34	RML-130/RML-127	78	81	194	72	2.0	1.5	1.0	8.6
35	RML-121/RML-118	74	76	178	63	2.3	2.0	3.0	6.6
36	RML-129/RML-121	74	76	189	74	3.5	3.0	2.3	4.7
37	(RML-32/RML-17)/RML-17	74	76	194	67	3.0	2.8	1.8	6.2
38	(RML-95/RML-96)/RML-17	75	81	198	78	2.3	2.3	1.8	6.4
39	(RML-86/RML-96)/RML-17	76	78	210	93	3.0	2.3	3.3	7.3
40	RAMPUR HYBRID-2/RML-17	74	77	193	80	3.0	2.3	1.3	7.5
41	(RML-4/RML-17)/RML-17	76	78	207	89	3.0	2.4	1.3	6.9
42	DEKALB DOUBLE	73	76	190	82	2.5	2.3	1.5	8.9
	Mean	76	79	199	76	2.5	2.3	1.8	7.1
	F-test	**	**	ns	**	*	ns	**	**
	CV%	0.3	0.2	13.5	15.7	23.3	25.1	32.4	23.5
	$LSD_{0.05}$	0.5	0.4	54	24.1	1.2	1.1	1.4	3.4

Table 8. Mean yield and other characters of single cross hybrids in coordinated hybrid trial at Belachapi

S. N.	Genotype	50%		Ht. in cm		Aspects (1-5)			GY
		Anthesis	silking	PHT	EHT	PA	EA	HC	t/ha
1	RML-87/RL-105	78	81	205	81	1.7	2.0	1.7	10.7
2	RML-95/RL-105	78	81	189	75	2.7	2.3	2.0	9.4
3	RML-83/RL-197	79	82	222	89	2.2	2.5	2.2	8.2
4	RML-19/NML-2	80	83	189	78	2.2	2.3	1.8	7.6
5	RML-68/RL101	78	82	193	56	1.8	2.0	1.7	7.4
6	RL-21/RL-101	79	82	188	69	2.0	2.0	1.5	7.7
7	RL-36/RL-197	79	83	204	73	1.8	1.8	2.0	7.8
8	RL-153/RL-105	79	82	207	74	1.8	2.0	1.2	8.9
9	RML-4/RL-111	81	81	198	78	2.0	2.2	1.2	5.9
10	RL-151/RL111	79	82	222	88	2.2	2.2	2.0	5.9
11	RL-150/RL-111	78	81	215	74	2.2	2.0	1.3	6.0
12	RML-98/RL-105	79	82	208	72	1.7	2.0	2.2	9.6
13	RML-5/RL-105	76	80	210	69	2.5	2.2	1.3	8.8
14	RL-180/RL-105	79	83	178	66	2.7	2.5	1.2	11.0
15	RML-55/RL-105	79	82	209	92	1.5	1.8	1.3	7.6
16	RML-85/RL-105	79	83	220	83	1.8	1.8	1.8	9.8
17	RML-57/RL-105	79	82	231	85	1.8	2.2	1.2	7.3
18	(RAMPUR HYBRID)/RML-17	78	81	222	81	2.7	2.3	1.5	8.2
19	(RML-4/RML-17)/RML-17	79	83	185	69	2.0	2.2	2.0	8.2
20	RML-32/RML-17)/RML-17	79	83	204	77	2.3	2.3	2.0	8.2
21	(RML-95/RML-97)/RML-17	78	81	194	73	2.7	2.3	2.0	8.8
22	(RML-86/RML-96)/RML-17	77	80	210	74	2.2	2.2	2.3	8.4
23	RML-32/RML-17	78	81	202	61	2.2	2.3	1.5	8.9
24	RML-4/RML-17	79	82	195	77	1.7	1.8	1.2	10.0
25	Decalb Double	78	81	188	77	2.3	2.5	1.8	10.5
	Mean	79	82	204	76	2.1	2.2	1.7	8.4
	F-test	ns	Ns	**	ns	ns	ns	ns	ns
	CV%	2.2	1.9	5	14.7	24.9	20.5	31.9	26.8
	$LSD_{0.05}$	2.8	2.6	16.6	18.3	0.85	0.7	0.95	3.7

Table 9. Mean yield and other characters of hybrids tested under coordinated farmer's field trial at Belachapi

S. N.	Genotype	50%		Ht. in cm		GY t/ ha	Aspects (1-5)		
		anthesis	silking	PHT	EHT		HC	PA	EA
1	RML-95/RML-96	78	82	190	75	5.4	2.5	3.5	3
2	RML-86/RML-96	78	81	178	68	8.2	1.5	2.5	2
3	(RML-95/RML-96)/RML-17	79	81	188	80	4.4	1	2	1.5
4	(RML-86/RML-96)/RML-17	76	79	195	75	4.3	1	2	2.5
5	RML-4/RML-17	75	78	230	78	4.4	1	2.5	2
6	RML-32/RML-17	75	79	200	110	3.5	2	3.5	2.5
7	RAMPUR HYBIRD - 2	79	83	203	98	3.1	2	3.5	2.5
8	DECALB DOUBLE	75	78	185	80	1.8	2.5	2	2.5

Results of hybrids from hills

During 2014 summer maize hybrids were evaluated in different hill stations for the identification of superior high yielding Genotype & evaluated twenty single cross hybrids including two checks. At Khumaltar conditions the tested hybrids were significantly difference for grain yield production & all the Genotype produced more than 8 t/ha grain yield. The selected Genotype for grain yield & resistant for disease point of view were RML-95/RML-96, RML-32/RML-17, RML-4/RML-17, RML-86/RML-96, KYM-33/KYM-35//RL-111, KP45OR/RML-4, RML-95/RL-105, RML-4/RL-111, JM-8 & RML-5/RL-105 (Table-9). In case of Pakhribas two Genotype namely; RL-153/RL-105 & JM-8 produced more than 6 t/ha grain yield (Table-10) & at Kabre the selected hybrids for grain yield & other agronomic traits were RML-32/RML-17, RML-4/RML-111 & JM-4 (Table-11). The combined result over three locations revealed that Khumal Hybrid-2, JM-8, RML-32/RML-17 & RL-153/RL-105 performed better & produced highest grain yield as compared to other tested hybrids (Table-12). Coordinated farmer's field trials (CFFT) on hybrid maize were also conducted at all three locations with six NMRP developed single cross hybrids & one check hybrid. The result from Khumaltar revealed that the selected hybrids for grain yield & other agronomic traits were Khumal Hybrid-2, RML-95/RML-96 & RML-32/RML-17 (Table-13). In Pakhribas conditions only the Khumal Hybrid-2 produced highest grain yield over the check hybrid (Table-14). At Kabre all the tested hybrids produced more than 8 t/ha grain yield and highest yield was obtained from RML-4/RML-17 (14.5 t/ha) (Table-15).

Table 10. Mean yield and other characters of single cross hybrids in coordinated hybrid trial at Khumaltar

S. N.	Genotype	50%		Ht. in cm		Aspects (1-5)			Disease scoring (1-5)				GY
		Anth	Silk	PHT	EHT	PA	EA	HC	BLSB	NLB	E. rot	GLS	kg/ha
1	RML-95/RML-96	69	72	258	132	2.3	3	1.8	1.5	1.8	1	1	12563
2	RML-32/RML-17	66	68	251	111	2	2	1.1	1.8	3	1	1	14155
3	RML-4/RML-17	70	73	244	128	2.3	1.8	1	2.3	2.5	1.3	1	11336
4	RML-86/RML-96	68	70	252	125	3	3.3	2.3	2	1.5	1	1	11093
5	KYM-33/KYM-35//RL-111	67	69	246	127	2.5	2.8	1.5	1.8	1	1	1	10377
6	Khumal hybrid-2	67	69	251	125	2.8	1.8	1	1	1	1	1	14660
7	RML-6/RML-19	68	69	214	98	3.3	2.8	1.3	2	1.3	1.3	1	6161
8	KP45OR/RML-4	68	69	228	115	1.8	2	1.5	1.5	1.3	1	1	11353
9	KP45CB/RL-84	66	68	248	127	2.8	3.5	3	1.8	1.5	1	1	8828
10	RML-95/RL-105	70	72	264	150	2.5	2.8	2.3	1.8	1.8	1	1	14595
11	RL-153/RL-105	68	70	259	136	2.3	2.3	1.8	1	1	1	1	11733
12	RML-4/RL-111	68	70	257	138	2	2	1	1.5	1.3	1	1	13628
13	RML-98/RL-105	69	71	266	142	2.3	2	1.5	1.8	1.5	1	1	13001
14	JM-1	61	63	225	102	2	2.3	1.8	1.5	1	1	1	8606
15	JM-4	63	65	257	116	2.5	2	1.8	1	1.3	1.5	1	11012
16	JM-7	64	66	209	91	3.5	3	1.8	2	1.5	1.8	1.3	6780
17	JM-8	65	68	249	116	2.3	2	1	1.5	1	1.5	1	12732
18	RML-5/RL-105	71	73	262	131	2.8	2.3	1.3	1.5	1	1	1	12479
19	Rampur hybrid-2 (Nchk)	68	70	237	126	2.3	2.5	1.3	1	1.8	1	1	8134
20	Rajkumar (IChk)	70	72	242	121	2.3	2.3	1.5	1.3	1.5	1.3	1	10067
	Grand mean	67	69	246	123	2.5	2.4	1.6	1.6	1.5	1.1	1	11165
	F-test	**	**	**	**	*	*	**	ns	**	ns	Ns	**
	CV%	1.8	1.6	3.7	7.5	17	17.5	26	37.3	24.1	30.8	7.8	12.5
	$LSD_{0.05}$	2.5	2.3	18.8	19	0.8	0.9	0.9	1.2	0.8	0.7	0.2	2913

Table 11. Mean yield and other characters of single cross hybrids in coordinated hybrid trial at Pakhribas

S. N.	Genotype	50%		Height in cm		Disease scoring (1-5)				Mat. days	GY kg/ha
		anthesis	Silking	plant	ear	BLSB	E rot	GLS	TLB		
1	RML-95/RML-96	90	95	207	112	1.5	1.3	1.8	3.3	137	3523
2	RML-32/RML-17	87	94	200	96	2	1.1	1.3	2.5	131	4005
3	RML-4/RML-17	91	96	220	116	1.5	3	1.8	3.5	136	2075
4	RML-86/RML-96	90	93	222	117	1.5	0.5	1.3	2.3	136	3299
5	KYM-33/KYM-35//RL-111	88	91	228	122	2	4.3	1.8	2.8	134	3052
6	Khumal hybrid-2	85	88	245	149	1.5	2.4	1.3	2	138	5280
7	RML-6/RML-19	88	94	205	109	2	2.1	1.3	1.8	139	3637
8	KP45OR/RML-4	84	88	197	103	2	2.3	1.3	2.3	140	3060
9	KP45CB/RL-84	85	89	225	115	1.5	1.8	1.3	3.3	133	2630
10	RML-95/RL-105	96	99	218	126	2.5	1.3	1.8	3.5	137	3549
11	RL-153/RL-105	87	90	210	110	2	0.3	1	1.8	138	6695
12	RML-4/RL-111	88	92	207	111	2.5	1.8	1.8	3.5	136	3919
13	RML-98/RL-105	91	95	212	106	1.5	0.5	1.3	2.3	141	4069
14	JM-1	74	76	189	91	2	20	1.8	2.8	132	4844
15	JM-4	79	83	225	109	2	7.9	1.3	2.5	127	5481
16	JM-7	77	82	186	82	2.3	16.3	1.8	3.8	128	4226
17	JM-8	82	87	231	108	2.5	0.4	1	1.5	132	6359
18	RML-5/RL-105	92	97	237	125	2	0	1.3	1.8	141	5356
19	Rampur hybrid-2 (Nchk)	94	96	215	118	2	1.9	1.8	3.5	140	2733
20	Rajkumar (IChk)	89	93	213	112	2.5	1.1	1.3	2.3	141	3876
	Grand mean	87	91	214	112	2	3.5	1.4	2.6	136	408
	F-test	**	**	*	**	**	**	**	*	**	*
	CV%	2.4	2.4	5.9	6.4	4	38.2	7.6	8.3	0.5	25.1
	$LSD_{0.05}$	4.3	4.5	26.4	14.8	0.17	2.5	0.2	0.5	1.3	2147

Table 12. Mean yield and other characters of single cross hybrids in coordinated hybrid trial at HCRP Kabre

SN	Genotype	Ht. in cm		GY kg/ha
		PHT	EHT	
1	RML-95/RML-96	230	104	5523
2	RML-32/RML-17	221	107	6005
3	RML-4/RML-17	219	106	3968
4	RML-86/RML-96	239	114	5365
5	KYM-33/KYM-35×RL-111	221	109	3876
6	KYLM-33/KYM-35	249	110	4851
7	RML-6/RML-19	208	102	4549
8	PU502/RML-4	215	109	5178
9	PU5CG/RL-84	244	124	3734
10	RML-95/RL-105	248	107	4805
11	RL-153/RL-105	238	123	5590
12	RML-4/RL-111	237	112	5843
13	RML-98/RL-105	223	114	5098
14	JM-1	200	108	3825
15	JM-4	255	142	6039
16	JM-7	203	111	3945
17	JM-8	238	130	5643
18	RML-5/RL-105	246	132	4540
19	Rampur Hybrid-2	206	96	4311
20	Rajkumar	203	101	5079
	Grand mean	227	113	4888
	F-test	**	**	Ns
	CV%	5.7	7.8	15.8
	$LSD_{0.05}$	26.9	18.4	1618

Table 13. Combined means yield and other characters of single cross hybrids in coordinated hybrid trial over the hill locations

SN	Genotype	H. in cm		GY
		PHT	EHT	kg/ha
1	RML-95/RML-96	208	104	7072
2	RML-32/RML-17	199	99	7779
3	RML-4/RML-17	203	98	6092
4	RML-86/RML-96	218	101	6681
5	KYM-33/KYM-35×RL-111	211	104	5739
6	KYLM-33/KYM-35	220	105	7788
7	RML-6/RML-19	196	99	4656
8	PU502/RML-4	202	99	6962
9	PU5CG/RL-84	201	99	5299
10	RML-95/RL-105	220	116	7940
11	RL-153/RL-105	209	102	8006
12	RML-4/RL-111	206	98	7758
13	RML-98/RL-105	209	107	7329
14	JM-1	202	103	5728
15	JM-4	217	110	7194
16	JM-7	202	105	4927
17	JM-8	218	116	8356
18	RML-5/RL-105	217	111	7432
19	Rampur Hybrid-2	203	101	5219
20	Rajkumar	191	107	6284
	Grand mean	208	104	6712
	Location (L)	**	**	**
	Genotype(G)	*	ns	**
	L × G	**	ns	**
	CV%	7.2	15.6	7.7
	$LSD_{0.05}$	29.8	32.5	2431

Table 14. Mean yield and other characters of hybrids in Co-ordinated farmer's field trial at Khumaltar

S. N.	Genotype	50%		Ht. in cm		GY	Aspect(1-5)		Scores (1-5)				
		Anthesis	Silking	PHT	EHT	kg/ha	PA	EA	HC	GLS	NLB	BLSB	E rot
1	RML-4/RML-17	67	69	221	109	7590	2	1.5	1	3	3	1.5	1
2	RML-32/RML-17	66	68	227	96	8944	2.5	2	1.5	2.5	2	1.5	1.5
3	RML-95/RML-96	68	70	239	121	9033	3	3	2	2	1	1	1.5
4	RML-86/RML-96	69	71	230	117	8516	2	3	3.5	2	1	1	3
5	Khumal hybrid-2	67	69	247	125	9762	2	1.5	1	1.5	1	1	1.5
6	Rampur Hybrid-2	71	73	234	118	6407	2	2.5	1.5	2	1..5	1	1
7	Rajkumar	69	71	236	107	8857	2	2.5	1.5	3	2	2	1
	Grand mean	68	70		113	8444							
	F-test	ns	ns		ns	ns							
	CV%	3.4	3.3		7.7	16.1							
	$LSD_{0.05}$	5.6	5.6		21	3321							

Table 15. Mean yield and other characters of hybrids in coordinated farmer's field trial at Pakhribas

SN	Genotype	50%		Ht. cm		Disease score (1-5)					Mat.	GY
		anthesis	silking	PHT	EHT	BLSB	E rot	TLB	GLS	HC	Days	kg/ha
1	RML-4/RML-17	78	80	219	123	1.7	0.1	4.3	1.7	2.2	121	3613
2	RML-32/RML-17	75	78	206	113	2	1.2	4.3	1.7	2	120	3725
3	RML-95/RML-96	77	80	226	129	1.8	1.5	3.7	1.5	2.5	122	5411
4	RML-86/RML-96	75	80	228	129	1.3	0.3	3.3	1.3	2.2	123	5201
5	Khumal hybrid-2	74	77	255	150	1.3	0.8	2.3	1.2	1.5	121	6289
6	Rampur Hybrid-2	80	83	229	134	1.8	0.7	3.7	1.3	2	126	4915
7	Rajkumar	76	81	234	135	1.3	1.1	3	1.3	1.7	127	5828
	Grand mean	76	80	228	130	1.6	0.8	3.5	1.4	2	123	4997
	F-test	ns	ns	**	**	*	ns	**	ns	ns	ns	*
	CV%	2.9	2.9	4.1	4.5	14	58	13.4	20.2	2.8	2.8	19.2
	$LSD_{0.05}$	4	4.2	16.7	10.4	0.4	0.8	0.8	0.5	6.2	6.2	1704

Table 16. Mean yield and other characters of hybrids in Coordinated farmer's field trial at HCRP Kabre

SN	Genotype	Ht. in cm		GY kg/ha
		PHT	EHT	
1	RML-4/RML-17	198	93	14513
2	RML-32/RML-17	207	97	8945
3	RML-95/RML-96	216	124	11184
4	RML-86/RML96	249	142	9255
5	KYM-33/KYM-35	246	136	11022
6	Rampur Hybrid-2	216	114	10625
7	Rajkumar	212	98	11302

2.1.2 Evaluation of CIMMYT hybrid experiments and HTMA hybrids

Two sets of hybrids received from CIMMYT Hyderabad as Global maize hybrid trials and each experiment contained 55 treatments and planted in winter season during 2014/15 at NMRP, Rampur with the plot size of 2 rows of 4m length. The experimental result from Global hybrid-1 revealed that except plant height and ear height all other traits were significantly difference and CAHCH142S3 produced the highest grain yield (10.6 t/ha) followed by RML-32/RIVS3 (10.1 T/HA) and CAHCH144S3 (10.0 t/ha), respectively (Table-16). From the result of Global hybrid-1, all the traits were significantly difference and the grain yield was recorded slightly lower than earlier experimS. However the genotype CAHCH140S3 produced significantly highest grain yield (8.7 t/ha) followed by CAHCH142 (8.2 t/ha) (Table-17)

Table 17. Mean yield and other characters of Global maize hybrids-1 at Rampur

SN	Genotype	50%		Ht. in cm		GY t/ha
		Anthesis	Silking	Plant	Ear	
1	CAHCH 140S3	73	82	185	110	8.8
2	CAHCH 140S3	72	75	190	105	6.9
3	CAHCH 140S3	78	83	175	80	7.0
4	CAHCH 140S3	71	75	170	95	7.0
5	CAHCH 140S3	71	75	175	70	6.9
6	CAHCH 140S3	67	70	175	90	6.0
7	CAHCH 140S3	72	76	165	85	7.3
8	CAHCH 140S3	70	79	175	90	9.6
9	CAHCH141S3	80	84	180	85	6.6
10	CAHCH141S3	68	77	170	80	7.9
11	CAHCH141S3	74	82	165	85	7.5
12	CAHCH141S3	75	79	175	80	7.5
13	CAHCH141S3	77	81	165	75	6.8
14	CAHCH141S3	81	84	180	90	9.2
15	CAHCH141S3	78	83	175	90	8.0
16	CAHCH141S3	81	85	180	90	8.4
17	CAHCH141S3	73	76	170	90	9.4
18	CAHCH142S3	82	84	175	70	7.6
19	CAHCH142S3	82	82	165	85	7.2
20	CAHCH142S3	69	82	170	85	10.6
21	CAHCH142S3	81	85	165	95	9.3
22	CAHCH142S3	82	86	160	80	7.8
23	CAHCH142S3	81	87	185	100	9.2
24	CAHCH142S3	77	85	170	75	8.6
25	CAHCH142S3	69	76	160	70	6.9
26	CAHCH142S3	74	84	165	80	8.9
27	CAHCH142S3	82	85	170	75	8.0
28	CAHCH142S3	79	83	185	95	9.1
29	CAHCH142S3	74	78	175	95	6.3
30	CAHCH143S3	64	68	170	80	4.5
31	CAHCH143S3	69	72	135	110	6.6
32	CAHCH143S3	82	86	170	80	7.2
33	CAHCH143S3	80	84	180	80	8.1
34	CAHCH143S3	82	86	170	75	8.5
35	CAHCH143S3	83	86	165	75	7.1

SN	Genotype	50%		Ht. in cm		GY t/ha
		Anthesis	Silking	Plant	Ear	
36	CAHCH143S3	82	85	160	65	8.9
37	CAHCH143S3	78	83	145	70	6.8
38	CAHCH143S3	76	81	185	80	8.3
39	CAHCH143S3	84	86	160	75	7.0
40	CAHCH144S3	81	86	172.5	70	8.1
41	CAHCH144S3	78	82	155	65	7.2
42	CAHCH144S3	77	82	175	75	8.4
43	CAHCH144S3	82	85	190	100	10.0
44	CAHCH144S3	63	67	150	70	4.6
45	CAHCH144S3	66	68	175	75	7.6
46	RML4/RMLS3	83	87	185	100	8.7
47	RML32/RIVS3	80	84	175	100	10.1
48	RML95/RIVS3	79	83	190	95	7.7
49	RML86/RIVS3	73	83	185	105	7.7
50	RML4/RMS3	81	84	185	100	8.0
51	RML32/RMS3	80	84	170	85	6.6
52	RML95/RMS3	83	83	175	90	8.9
53	RML86/RMS3	81	84	175	90	8.8
54	HYBRID2/RMS3	80	84	185	110	8.4
55	HHYBRID2 S3	80	74	170	95	8.2
	Mean	77	81	172	86	7.9
	F-test	**	**	NS	NS	**
	CV%	4.2	3.5	10.2	18	14.1
	$LSD_{0.05}$	6.5	5.7	35	31	2.2

Table 18. Mean yield and other characters of Global maize hybrids-2 at Rampur

SN	Genotype	50%		Height in cm		GY t/ha
		Anthesis	Silking	plant	ear	
1	CAHCH 140S3	71	69	165	98	8.7
2	CAHCH 140S3	69	73	158	65	1.9
3	CAHCH 140S3	70	73	150	68	1.8
4	CAHCH 140S3	70	73	173	63	6.5
5	CAHCH 140S3	71	74	170	70	5.5
6	CAHCH 140S3	74	77	170	80	6.9
7	CAHCH 140S3	84	86	190	103	6.2
8	CAHCH 140S3	75	79	165	75	7.0
9	CAHCH141S3	76	79	170	65	3.6
10	CAHCH141S3	80	84	187	73	5.8
11	CAHCH141S3	75	79	173	100	5.4
12	CAHCH141S3	77	76	173	95	5.6
13	CAHCH141S3	75	79	168	73	4.6
14	CAHCH141S3	82	85	195	93	7.2
15	CAHCH141S3	77	81	153	58	5.5
16	CAHCH141S3	81	86	183	93	7.1
17	CAHCH141S3	80	84	168	85	6.7
18	CAHCH142S3	81	84	203	105	8.2
19	CAHCH142S3	82	86	193	90	5.6
20	CAHCH142S3	74	77	170	90	4.4
21	CAHCH142S3	70	74	198	95	5.3
22	CAHCH142S3	79	82	140	63	4.8
23	CAHCH142S3	73	77	168	80	4.9
24	CAHCH142S3	83	86	190	108	7.6
25	CAHCH142S3	78	80	190	103	4.4
26	CAHCH142S3	83	86	205	118	8.0
27	CAHCH142S3	75	79	181	75	4.8
28	CAHCH142S3	78	82	180	75	5.6
29	CAHCH142S3	62	66	180	88	3.9
30	CAHCH143S3	63	67	168	83	3.7
31	CAHCH143S3	74	77	181	95	5.9
32	CAHCH143S3	63	67	178	85	4.5
33	CAHCH143S3	76	80	175	78	6.8
34	CAHCH143S3	77	80	178	78	5.7
35	CAHCH143S3	76	80	175	70	5.8

SN	Genotype	50%		Height in cm		GY t/ha
		Anthesis	Silking	plant	ear	
36	CAHCH143S3	74	78	158	68	6.4
37	CAHCH143S3	74	78	165	75	4.9
38	CAHCH143S3	77	82	180	78	6.6
39	CAHCH143S3	78	81	179	83	6.0
40	CAHCH144S3	78	82	178	75	4.3
41	CAHCH144S3	78	82	175	78	4.7
42	CAHCH144S3	79	83	170	83	6.1
43	CAHCH144S3	82	86	203	100	6.8
44	CAHCH144S3	74	78	161	53	5.2
45	CAHCH144S3	74	77	184	95	7.0
46	RML4/RMLS3	84	87	170	83	6.9
47	RML32/RIVS3	81	84	180	73	5.8
48	RML95/RIVS3	81	84	198	100	6.2
49	RML86/RIVS3	80	84	165	98	5.6
50	RML4/RMS3	80	79	170	83	5.9
51	RML32/RMS3	78	83	148	50	5.4
52	RML95/RMS3	79	86	198	98	6.0
53	RML86/RMS3	79	84	165	80	5.7
54	HYBRID2/RMS3	79	83	189	105	6.6
55	HHYBRID2 S3	82	85	160	73	5.4
	Mean	76	80	175	83	5.7
	F-test	**	**	**	**	**
	CV%	4.9	4.4	7.5	13.3	13.5
	$LSD_{0.05}$	7.5	7	27	22	1.5

2.1.3 Heat Tolerant Maize in Asia (HTMA) experiments

Different sets of experiments were received from CIMMYT Hyderabad and planted in Rampur, Nepalgunj and Surkhet both in normal and heat stress conditions. However at Surkhet the experiment was planted in poor land and data was not recorded. On-farm experiments were also conducted at Dumarwana, Nijgadh of Bara district and Keureni of Nawalparasi district and the same set was also planted at Rampur also. Multidisplinary as well as different stakeholders in famer's field and selected some outstanding hybrids for further verification and deploymS. From the summary result across the locations RML-95/RML-96 produced the highest grain yield (9.7 t/ha) followed by RML-32/RML-17 (9.5 t/ha) and CAH152 (9.4 t/ha), respectively (Table-19).

Table 19. Details of HTMA experiments conducted during 2015 winter and spring season

SN	Trial code	No. of		P size	spacing	P date	H date	Location	Environ.
		Ent	rep						
1	ATTC-15	20	2	1R× 4m L	60×20cm	18 Mar, 15	4 July, 15	Nepalgunj	Heat
2	ATTC-215	30	2	1 R× 4m L	60×20cm	19 Mar, 15	4 July, 15	Nepalgunj	Heat
3	AS2BH-42	20	3	2R×3m L	60×20cm	16 Mar,15	5 July, 15	Nepalgunj	Heat
4	AS2BH-52	12	3	2R×4m L	60×20cm	17 Mar,15	7 July,15	Nepalgunj	Heat
5	AS2BH-62	40	3	2R×4m L	60×20cm	18 Mar,15	8 July,15	Nepalgunj	Heat
6	AS2BH-72	15	3	2R×4m L	60×20cm	18 Mar,15	8 July,15	Nepalgunj	Heat
7	AS3BMHR-15	10	3	4R×4m L	60×20cm	17 Mar, 15	7 July,15	Nepalgunj	Heat
8	MPS3TC-111	330	2	1R×3m L	60×20cm	17 Mar,15	6 July,15	Nepalgunj	Heat
9	MPS3TC-211	335	2	1R×4m L	60×20cm	17 Mar,15	9 July,15	Nepalgunj	Heat
10	AS2BR-15	10	3	2R×4m L	75×20cm	6 Mar,15	6 July,15	Rampur	Heat
11	AS2BR-25	10	3	2R×4m L	75×20cm	6 Mar,15	6 July,15	Rampur	Heat
12	AS3BMHS-117	15	3	4R×4m L	75×20cm	6 Mar,15	7 July,15	Rampur	Heat
13	AS3BEHS-118	10	3	4R×4m L	75×20cm	6 Mar,15	7 July,15	Rampur	Heat
14	MPS3TC-15	115	2	1R×4m L	75×20cm	6 Mar,15	8 July,15	Rampur	Heat
15	MPS3TC-23	325	2	1R×4m L	75×20cm	7 Mar,15	9-10 July,15	Rampur	Heat
16	MPS3TC-25	335	2	1R×4m L	75×20cm	7 Mar,15	11-12July,15	Rampur	Heat
17	On-farm demo. Of HTMA hyb.	30	1	8R×5m L	60×20cm	16 Nov, 14	7 May, 15	Rampur	Optim
18	On-farm demo. Of HTMA hyb.	30	1	8R×5m L	60×20cm	5 Nov, 14	16 April,14	Dumarwana	Optim
19	On-farm demo. Of HTMA hyb.	30	1	8R×5m L	60×20cm	4 Nov, 14	17 April,14	Nijgadh	Optim
20	On-farm demo. Of HTMA hyb.	30	1	7R×5m L	60×20cm	22 Nov,14	12 May,14	Keureni	Optim

Table 20. Mean yield and other characters HTMA hybrids tested during 2014/15 winter season

S.N.	Genotype	Grain yield (t/ha)				Plant Ht (cm)			
		D/wana	Nijg	Keur	Ramp	D/wana	Nijg	Keur	Ramp
1	CAH151	10.7	9	8	9	145	130	180	215
2	CAH152	9.5	9.4	10.1	8.6	155	150	215	210
3	CAH153	10	8.7	8.9	8.1	145	140	205	195
4	CAH154	9.6	9.9	10.1	7.7	165	155	205	180
5	CAH155	9.9	6.6	8	5.9	125	120	165	170
6	CAH156	11.4	7.4	4.1	5.7	130	125	185	170
7	CIH127	6	10.6	5.1	5.2	120	110	150	120
8	CAH157	6.8	6.5	6.9	5.3	145	135	160	165
9	CIH122	7.1	6.3	8.4	5.5	130	125	170	130
10	CAH158	10.4	6.8	12.3	2.9	190	160	205	210
11	CAH159	10.3	5.8	11.4	6.3	175	160	190	190
12	CAH1520	8.8	6.1	11.3	6.2	145	150	165	165
13	CAH1521	8.4	3.7	9.7	5.4	175	140	200	185
14	CAH1510	7.9	7.6	6.2	6.3	145	140	155	150
15	CAH1511	11.2	6.8	9	7.1	160	170	190	175
16	CAH1519	10.6	7.4	7.7	8.9	160	125	165	185
17	CAH1512	9.9	6.4	9.4	8	180	150	180	180
18	CAH1513	10.6	7.8	5.4	7.3	155	155	160	155
19	CAH1514	10.1	8	7.6	8.6	150	140	195	230
20	CAH1515	10.2	7.3	9	7.5	150	130	185	175
21	CAH1516	11.4	7.9	8.8	7.9	165	140	210	115
22	CAH1424	10.1	9.5	8.5	8.5	150	135	185	210
23	CAH1517	8.5	9.7	7.1	8.5	155	160	170	160
24	CAH1518	8.2	8.7	10.5	7.1	155	145	180	170
25	900M Gold	9.3	7.7	7.7	8.8	165	140	195	230
26	30V92	8.6	10.4	9.1	5	155	140	200	180
27	RML-32/RML-17	10.6	11.4	7.6	8.3	135	175	200	175
28	RML-95/RML-96	11.2	11	9	7.5	140	160	205	165
29	RML-86/RML-96	9.7	7.6	10.9	7.4	140	150	215	175
30	Rampur Hybrid-2	10.7	8.7	9.2	6.3	175	125	210	185

Table 21. Mean yield and other characters HTMA hybrids tested during 2014/15 winter season

S. N.	Genotype	Ear ht. in cm				Plant aspect (1-5)				E. tur (1-5)			
		D/wana	Nijg	Keur	Ramp	D/wana	Nijg	Keur	Ramp	D/wana	Nijg	Keur	Ramp
1	CAH151	35	60	80	110	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
2	CAH152	65	55	115	90	2	2	1.5	2	1.5	1.5	1.5	1.5
3	CAH153	60	55	90	90	1.5	2	1	1.5	1.5	1.5	1.5	1.5
4	CAH154	65	60	100	80	1	2	2	2	2	2	1.5	2
5	CAH155	55	50	70	80	1	2.5	1	1.5	1.5	3	1.5	2
6	CAH156	55	55	65	85	2	2	2.5	2	2	3	2.5	2.5
7	CIH127	50	50	65	50	2.5	3.5	2.5	2	2.5	3.5	2.5	1.5
8	CAH157	70	60	75	65	2.5	3	2	1.5	1.5	4.5	2	2.5
9	CIH122	65	65	90	60	2	2.5	2	2	2.5	4.5	1.5	2
10	CAH158	100	90	115	120	2	1.5	2	2	1.5	1.5	1	1.5
11	CAH159	90	80	100	130	2	2.5	1.5	2	1.5	2.5	1.5	1.5
12	CAH1520	75	90	70	70	2.5	1.5	2.5	2.5	1.5	2	1.5	1.5
13	CAH1521	70	80	90	85	1.5	1.5	1.5	1.5	1.5	2	1.5	1.5
14	CAH1510	50	70	50	40	2	3	2.5	2	1.5	3	1.5	1.5
15	CAH1511	50	70	60	60	1.5	2.5	2	1.5	1.5	2	1.5	1.5
16	CAH1519	60	25	70	50	1.5	3	1.5	1.5	1.5	3.5	1.5	1.5
17	CAH1512	80	60	90	50	1	2.5	2.5	2	1.5	2.5	1.5	1.5
18	CAH1513	65	70	50	40	1.5	2.5	2.5	1.5	1.5	2.5	1.5	1.5
19	CAH1514	60	70	85	90	1.5	1.5	2	1.5	1.5	1.5	2	1.5
20	CAH1515	60	50	100	70	1.5	3.5	2	1.5	1.5	1.5	1.5	1.5
21	CAH1516	65	65	80	90	1	1.5	2.5	2.5	1.5	1.5	1.5	2
22	CAH1424	60	55	105	90	1.5	2	1.5	1.5	1	1.5	1.5	1.5
23	CAH1517	70	70	90	70	2	2	2	2	1.5	2.5	1.5	1.5
24	CAH1518	50	65	80	60	1.5	1.5	1.5	2.5	1.5	1.5	1.5	1.5
25	900M Gold	70	60	90	130	2	2.5	2	3.5	1.5	2	1.5	1.5
26	30V92	60	60	100	80	2	2	2.5	3	2.5	2	3	4.5
27	RML-32/ RML-17	65	80	70	90	2	1.5	2	2	2	1.5	2	2.5
28	RML-95/ RML-96	80	55	100	100	1.5	1.5	1.5	1.5	1.5	2	1.5	2
29	RML-86/ RML-96	55	70	120	90	2	2	1.5	2	1.5	2.5	1.5	2
30	Rampur Hybrid-2	85	75	105	125	1.5	2	1.5	1.5	1.5	1.5	2	2.5

Table 22. Summary of Mean yield and other characters HTMA hybrids tested across the locations (Rampur, Keureni, Dumarwana & Nijgadh) during 2014/15 winter season

S. N.	Genotype	GY t/ha	Rank	PA (1-5)	Height (cm)		Cob dia. Cm	Cob leng cm	No. row /row	No. ker /row	Shell%
					Pht	Eht					
1	CAH151	9.2	5	1.5	168	71	4.4	15.2	13.5	30.1	70.4
2	CAH152	9.4	3	1.9	183	81	4.3	15.4	13.4	26.1	71.9
3	CAH153	8.9	8	1.5	171	74	4.3	15.2	12.9	27.8	74.2
4	CAH154	9.3	4	1.8	176	76	4	16.1	13.8	30.4	74.4
5	CAH155	7.6	24	1.5	145	64	4.1	13.2	12.2	25.4	70.6
6	CAH156	7.1	25	2.1	153	65	4.4	12.9	13.8	27.6	75.8
7	CIH127	6.7	29	2.6	125	54	4.3	12.2	12.9	28.1	74
8	CAH157	6.4	30	2.3	151	68	4	12.8	13.2	26.5	75.1
9	CIH122	6.8	27	2.1	139	70	4.3	11.8	12.5	25	74.6
10	CAH158	8.1	22	1.9	191	106	4.5	13.5	13.1	30.4	64.1
11	CAH159	8.4	16	2	179	100	4.4	13.5	12.1	29	66.7
12	CAH1520	8.1	21	2.3	156	76	4.1	14.2	12.8	29.2	74.2
13	CAH1521	6.8	28	1.5	175	81	4.4	14.4	13.6	26.7	69.4
14	CAH1510	7	26	2.4	148	53	4.2	14.2	13.4	28	72.5
15	CAH1511	8.5	14	1.9	174	60	4.2	14.6	13.3	26.4	70.2
16	CAH1519	8.7	11	1.9	159	51	4.5	14	13.4	27.5	69.1
17	CAH1512	8.4	18	2	173	70	4.4	14.9	13.4	29.8	68.8
18	CAH1513	7.8	23	2	156	56	4.4	14.8	13.8	27.4	68.5
19	CAH1514	8.6	13	1.6	179	76	4.4	13.6	13.6	29.2	71.4
20	CAH1515	8.5	15	2.1	160	70	4.6	14.4	13.5	26.5	69.2
21	CAH1516	9	7	1.9	158	75	4.7	14.1	14	27	67.4
22	CAH1424	9.2	6	1.6	170	78	4.5	14.1	13.7	28.7	68.9
23	CAH1517	8.4	17	2	161	75	4.3	15.1	13.3	30.2	71.5
24	CAH1518	8.6	12	1.8	163	64	4.3	15	13.4	28.6	72.2
25	900M Gold	8.4	19	2.5	183	88	4.4	14.5	14.8	31.5	69.3
26	30V92	8.3	20	2.4	169	75	4.1	14.3	13.3	30.6	77.7
27	RML-32/RML-17	9.5	2	1.9	171	76	4	13.4	11.2	29.1	76.4
28	RML-95/RML-96	9.7	1	1.5	168	84	4.5	13.4	14.4	27.8	69.7
29	RML-86/RML-96	8.9	9	1.9	170	84	4.3	13.5	14.4	27.6	67.8
30	Rampur Hybrid-2	8.7	10	1.6	174	98	4.7	13.3	14.1	27.5	66.8
	GM	8.3		1.9	164	73.9	4.3	14.1	13.4	28.1	71.1
	F-test	Ns		*	**	**	**	*	**	ns	**
	CV%	18.9		23.6	10.1	19.6	4.3	10.2	4.6	9.6	5.1
	$LSD_{0.05}$	2.2		0.64	23.5	20.3	0.26	2	0.87	3.8	5.1

2.1.4 Maize varietal improvement for hill and terai of Nepal

Variety Release

In this FY three early maturing maize varieties have been released for commercial cultivation for different agro ecological zones

S.N.	Variety	Parent	Maturity Day	Productivity (t/ha)	Recommendation Domain
1.	Arun-3	Arun-1EV	100	3.9	Terai, Inner Terai and foot hills summer season; winter and spring season in Terai and Inner Terai,
2.	Arun-4	Arun 4	113-115	4.2	Terai, Inner Terai and foot hills summer season; winter and spring season in Terai and Inner Terai,
3.	Arun-6	Pool-17	90	3.5	Terai, Inner Terai and foot hills summer season; winter and spring season in Terai and Inner Terai,

Ongoing Activities

Different yield performance trials as an early set IYTE, CVTE and CFFTEs were conducted in different locations and these sets were carried out in winter season at NMRP Rampur. All together 15, 17 and 6 Genotype were included in CVTE, IYTE and CFFTE sets respectively. In IYTE, RAMPUR S03 E02, ZM 627 and KY/POOL-17 were found high yielding with 2.97-3.86 mt/ha yield while EEYC1 was earliest with low yield 2.34 mt/ha. ZM 427 and ZM 423 were found promising in CVTE set in term of productivity with 4.7-4.9 mt/ ha. All the tested cultivars equally performed in CFFT trial in farmer's field yielding 2.96-3.54 mt/ ha compared to farmer's variety, 2.56 t/ha.

Table 23. Mean grain yield and desirable traits of IYTE early maize during 2071.

SN	Genotype	MF	FF	Plant ht	Ear ht	Y t/h	Pl/plot	Ear/p	Plt asp	Ear asp	Dis	Rot ear	HC
1	S03TEY-FM(ER)	60.	64.00	89.00	30.00	1.94	25.67	27.67	2.50	2.17	1.67	1.83	2.33
2	S03TEY-SEQ	64.33	68.00	134.67	55.33	1.43	19.67	22.00	2.33	2.00	1.50	1.67	2.50
3	ACROSS-2401	70.00	73.67	116.67	43.33	2.76	25.00	29.00	1.83	1.67	1.67	1.83	2.33
4	SO3TEY/LN	69.33	72.33	102.67	38.33	2.09	26.67	30.00	2.17	2.17	2.00	1.33	1.83
5	ACO-2401/ACO2402	68.00	68.67	121.33	41.67	1.97	24.00	25.67	2.17	2.17	1.67	1.33	2.17
6	POP-445	63.00	67.33	138.00	56.67	1.39	25.00	26.67	2.33	2.50	1.67	1.00	2.33
7	RAMPUR S03 E02	66.00	69.33	133.00	46.00	2.97	27.67	31.00	2.17	2.00	2.00	1.80	2.17
8	ARUN-1	56.00	60.33	142.00	59.00	2.25	26.00	29.67	2.33	2.33	1.83	2.00	1.66
9	FARMERS VARIETY	58.67	62.67	151.67	61.00	3.41	30.00	36.33	1.67	1.83	1.67	1.50	1.67
10	ZM-627	68.00	70.67	121.00	44.33	3.86	28.67	32.67	1.67	1.67	2.00	1.33	1.83
11	EEYC1	55.00	59.00	120.00	44.33	2.35	28.00	31.00	2.00	2.17	1.83	2.17	2.17

SN	Genotype	MF	FF	Plant ht	Ear ht	Y t/h	Pl/plot	Ear/p	Plt asp	Ear asp	Dis	Rot ear	HC
12	ZM-621/POOL-15	58.33	62.33	93.67	28.33	1.92	24.33	26.67	2.50	2.00	1.50	1.57	1.83
13	POOL-27	54.33	58.33	120.33	44.33	1.78	23.00	28.00	3.00	2.50	1.67	1.73	2.00
14	ZM-423	68.67	71.67	103.33	31.33	2.42	23.33	24.33	2.33	2.17	1.17	2.00	1.83
15	AC/POOL-17	62.33	66.00	111.33	48.33	1.59	21.00	23.00	2.17	2.33	1.50	1.83	1.83
16	KY/POOL-17	64.00	67.33	133.33	51.67	3.64	28.00	33.00	2.00	2.00	1.17	1.50	1.67
17	RAJAHAR LOCAL	70.33	73.67	136.67	64.33	2.11	30.67	30.67	2.50	2.17	1.50	1.50	1.83
	G Mean	63.3	66.78	121.69	46.37	2.35	25.69	28.67	2.22	2.11	1.65	1.64	2.00
	CV%	7.22	6.41	17.29	34.93	31.36	23.42	25.48	23.22	15.82	39.59	32.53	22.12
	F-test	0.00	0.00	0.04	0.25	0.00	0.73	0.68	0.29	0.15	0.96	0.90	0.38
	$LSD_{0.05}$	7.61	7.12	34.99	26.94	1.22	10.01	12.15	0.86	0.56	1.09	1.16	0.74

Table 24. Mean grain yield at 15% moisture percentages and other desirable traits of CVTE at NMRP, Rampur in 2071 winter

S.N.	Genotype	M Fld	F Fld	Plant Ht (cm)	Ear Ht (cm)	P asp	E asp	YT/ Ha	H cover	Pl Asp	E Asp	Dis	Rotten ears
1	POP-445	58.67	62.67	133.33	49.33	2.17	2.17	2.23	1.83	2.17	2.17	1.33	3.33
2	POP-446	55.00	58.67	115.00	45.00	2.33	2.67	2.32	2.00	2.33	2.67	1.67	2.33
3	S97TEYGHAYB(3)	58.00	61.33	110.00	35.67	3.00	3.00	1.35	2.67	3.00	3.00	1.33	4.33
4	POP-445/ POP-446	55.00	59.00	105.00	33.67	2.50	2.67	1.55	2.00	2.50	2.67	1.17	3.67
5	POP-45/POOL-17	57.33	61.00	160.00	58.33	1.67	2.17	3.14	2.00	1.67	2.17	1.33	4.33
6	R.C./POOL-17	59.00	63.00	131.67	58.67	2.33	2.17	3.05	2.17	2.33	2.17	2.33	5.00
7	POP-44/POOL-15	62.33	66.00	135.00	53.33	1.50	1.50	3.24	2.17	1.50	1.50	1.33	6.00
8	ARUN-2 (Std Chk)	56.00	59.67	141.00	50.00	1.83	2.00	2.66	1.67	1.83	2.00	1.33	5.00
9	FARMERS VARIETY	53.67	57.00	166.67	69.33	1.83	1.67	3.09	1.50	1.83	1.67	2.00	3.33
10	ZM-627	67.33	70.67	150.00	65.67	1.50	1.50	4.71	1.83	1.50	1.50	1.33	4.33
11	ZM-621/Pool-15	53.00	57.00	130.00	53.33	2.00	2.00	3.11	1.67	2.00	2.00	1.33	3.67
12	EEYC1	61.00	65.00	140.00	43.67	2.33	2.00	3.57	2.33	2.33	2.00	1.17	6.00
13	ZM-423	60.00	66.33	140.00	53.33	1.67	1.50	4.92	1.50	1.67	1.50	1.67	4.67
14	Pool-27	56.33	60.33	143.33	55.00	2.67	2.17	2.27	1.83	2.67	2.17	1.17	2.33
15	pool-15	62.00	65.33	139.33	56.67	1.67	2.00	3.49	1.83	1.67	2.00	1.67	4.00
	G Mean	58.31	62.20	136.02	52.07	2.07	2.08	2.98	1.93	2.07	2.08	1.48	4.16
	CV%	4.64	3.17	13.96	26.04	20.58	20.72	22.26	18.63	20.58	20.72	34.68	41.97
	Probability	0.00	0.00	0.03	0.15	0.00	0.00	0.00	0.03	0.00	0.00	0.29	0.33
	$LSD_{0.05}$	4.53	3.30	31.76	22.68	0.71	0.72	1.11	0.60	0.71	0.72	0.86	2.92

Table 25. Mean grain yield at 15% moisture percentages and other desirable traits of CFFTE at NMRP, Rampur on 2071 winter.

S.N.	Genotype	M Fld	F Fld	P Ht (cm)	E Ht (cm)	Plant/ plot	Ear/p	Plant Asp	Ear Asp	Rotten ear/Plot	GY (t/ha)
1	S97TEYGHA and B(3)	61.00	63.00	195.00	140.00	58.00	59.00	2.50	2.00	2.00	3.25
2	POP 445	58.00	62.00	199.00	135.00	56.00	57.00	2.30	2.00	2.50	3.54
3	Pool-15	56.00	60.00	171.00	70.00	61.00	65.00	1.50	1.50	2.00	2.96
4	Arun-4	46.00	50.00	200.00	100.00	78.00	79.00	2.20	1.50	3.00	3.45
5	Pool-27	56.00	60.00	155.00	80.00	60.00	71.00	1.50	2.00	2.00	3.22
6	Farmer's Variety	58.00	62.00	165.00	85.00	42.00	45.00	2.50	2.00	2.00	2.56
	G Mean	55.83	59.50	180.83	101.67	59.17	62.67	2.08	1.83	2.25	3.16

2.1.5 Development of Quality protein maize Genotype for terai and mid hills of Nepal

The results of CVT in 2014 summer season showed that at Salyan, Pakhribas and Kabre the combined analysis across locations revealed that all the tested Genotype were highly significant for grain yield, tasseling days, silking days, ear height and significant for plant height. The highest grain yield was obtained by Farmer's variety (4185 kg/ha) followed by S01SIYQ (3645 kg/ha), S01SIWQ-2 (3302 kg/ha) and Poshilo Makai-1 (3275 kg/ha). Farmer's variety had highest plant height (258.2 cm) while CELEYA S99-SIWQ had lowest plant height (203.8 cm). Maximum value of ear height was shown by Farmer's Variety (150.9 cm), while minimum value was recorded in CELEYA S99-SIWQ (108 cm). There was variation in tasseling days; the highest in S00TLWQ-B (66.17 days) and lowest in Farmer's variety (61.33 days). Similarly highest value of silking was given by CELEYA S99-SIWQ (69.17 days) and lowest value in Farmer's variety (64.5 days). There was highly significant G × E interaction for tasseling, silking, ear height, grain yield and significant for plant height. The highly significant G × E interactions indicated that Genotype performance was inconsistent across testing locations and need to be tested in several locations in order to select stable Genotype.

Table 26. Combined analysis of Genotype for agronomic traits under CVT at Salyan, Pakhribas and Kabre in 2014 summer season

SN	Genotype	Tasseling days	Silking Days	Plant height (cm)	Ear height (cm)	Grain yield (kg/ha)
1	S00TLWQ-B	66.17	69	237	128.8	1068
2	S01SIWQ-2	64.5	68	223.1	113.8	3302
3	CELEYA S99-SIWQ	66.5	69.17	203.8	108	1098
4	S00TLYQ-B	63.67	66.5	210.1	114.2	3195
5	S99TLWQ-B	63.67	66.83	218.5	119.9	2757
6	S03TLYQ-AB-01	65.17	69	223.2	113.2	2945
7	S01SIYQ	66.5	69.33	236.2	127.8	3645
8	S03TLYQ-AB-02	65.33	68.17	211.1	113.8	2669
9	Poshilo Makai-1	65.67	68.67	221.2	111.5	3275
10	Farmer's Variety (Rampur Composite)	61.33	64.5	258.2	150.9	4185
	Genotype	0.002	0.002	0.018	<.001	<.001
	Location	**	**	**	**	**
	G× L	**	**	ns	*	**
	$LSD_{0.05}$	3.247	3.887	3.887	1952	113.3
	CV%	2.4	2.8	2.8	7.9	19.3

The findings of CFFT in 2014 summer season showed that at Salyan, Pakhribas and Khumaltar the combined analysis across locations revealed that all the tested Genotype were significant for grain yield, plant height and ear height. The highest grain yield was obtained by S99TLYQ-HG-AB (6206 kg/ha) followed by S99TLYQ-B (5753 kg/ha), Poshilo Makai-1 (5747 kg/ha). Farmer's variety had highest plant height (258.2 cm) while S99TLYQ-HG-AB had lowest plant height (223.6 cm). Maximum value of ear height was shown by Farmer's Variety (143.8 cm), while minimum value was recorded in S99TLYQ-B (113.9 cm). The genotype × location interaction was non-significant for grain yield, plant height and ear height.

Table 27. Combined analysis of Genotype for agronomic traits under CFFT at Salyan, Pakhribas and Khumaltar in 2014 summer season

SN	Genotype	Plant height (cm)	Ear height (cm)	Grain yield (kg/ha)
1	Obatanpa	235.4	121.7	3925
2	RampurSO3FQ-O2	224.6	114.3	5166
3	S99TLYQ-HG-AB	223.6	116.8	6206
4	S99TLYQ-B	226.8	113.9	5753
5	Poshilo Makai-1	225	116.4	5747
6	Farmer's Variety (Rampur Composite)	258.2	143.8	5741
	Genotype	**	**	*
	F-test Location	**	*	**
	Genotype × Location	ns	ns	Ns
	Genotype	18.33	15.67	966.5
	$LSD_{0.05}$ Location	12.96	11.08	1173
	CV%	8.23	13.49	23.82

At Salyan the highest grain yield was obtained by Rampur Composite (7206 kg/ha) followed by S99TLYQ-HG-AB (6755 kg/ha), Poshilo Makai-1 (6409 kg/ha) . Farmer's variety had highest plant height (269.5 cm) while S99TLYQ-HG-AB had lowest plant height (218.8 cm). Maximum value of ear height was shown by Farmer's Variety (150.2 cm), while minimum value was recorded in S99TLYQ-B (115.8 cm). The genotype was highly significant for grain yield, non significant for plant height and significant for ear height.

Table 28. Evaluation of Genotype for agronomic traits under CFFT at Salyan in 2014 summer season

SN	Genotype	Plant height (cm)	Ear height (cm)	Grain yield (kg/ha)
1	Obatanpa	231.8	129.5	4280
2	RampurSO3FQ-O2	236.5	125.8	4479
3	S99TLYQ-HG-AB	218.8	135.8	6755
4	S99TLYQ-B	241.8	115. 8	4955
5	Poshilo Makai-1	233.1	128.8	6409
6	Farmer's Variety (Rampur Composite)	269.5	150.2	7206
	F-test	Ns	*	**
	$LSD_{0.05}$	34.94	20.11	1194.3
	CV%	8.1	8.4	11.6

At Pakhribas the highest grain yield was obtained by S99TLYQ-HG-AB (5298 kg/ha) followed by RampurSO3FQ-O2 (4756 kg/ha), S99TLYQ-B (4730 kg/ha).

Farmer's variety had highest plant height (269.5 cm) while S99TLYQ-HG-AB had lowest plant height (219.3 cm). Maximum value of ear height was shown by Farmer's Variety (144.8 cm), while minimum value was recorded in S99TLYQ-B (100.3). The genotype was significant for grain yield and ear height and highly significant for plant height.

Table 29. Evaluation of Genotype for agronomic traits under CFFT at Pakhribas in 2014 summer season

SN	Genotype	Plant height (cm)	Ear height (cm)	Grain yield (kg/ha)
1	Obatanpa	210.1	118.3	3131
2	RampurSO3FQ-O2	207.6	104.3	4756
3	S99TLYQ-HG-AB	219.3	118	5298
4	S99TLYQ-B	206.8	100.3	4730
5	Poshilo Makai-1	209.1	100.5	4249
6	Farmer's Variety (Rampur Composite)	256.1	144.8	4659
	F-test	**	*	*
	$LSD_{0.05}$	20.24	21.14	1276
	CV%	5.9	12.1	18.9

At Khumaltar the highest grain yield was obtained by Poshilo Makai-1 (7753 kg/ha) followed by S99TLYQ-HG-AB (7200 kg/ha), RampurSO3FQ-O2 (7017 kg/ha). Obatanpa had highest plant height (250.7 cm) while S99TLYQ-HG-AB had lowest plant height (239.2 cm). Maximum value of ear height was shown by RampurSO3FQ-O2 (177.2 cm), while minimum value was recorded in S99TLYQ-B (108.2 cm). The genotype was non-significant for grain yield and ear height and significant for plant height.

Table 30. Evaluation of Genotype for agronomic traits under CFFT at Khumaltar in 2014 summer season

SN	Genotype	Plant height (cm)	Ear height (cm)	Grain yield (kg/ha)
1	Obatanpa	250.7	166.8	4980
2	RampurSO3FQ-O2	240.7	177.2	7017
3	S99TLYQ-HG-AB	239.2	115.8	7200
4	S99TLYQ-B	244.2	108.2	6242
5	Poshilo Makai-1	244.7	129.7	7753
6	Farmer's Variety (Rampur Composite)	246.7	132.3	5763
	F-test	*	Ns	Ns
	$LSD_{0.05}$	3.38	25.62	3514.8
	CV%	4.7	8.6	21.1

- Selection of high yielding QPM Genotype for a particular location is the most important task in QPM development program.
- In CVT, S01SIYQ, S01SIWQ-2 and Poshilo Makai-1 were found high yielding Genotype across years and locations.
- In CFFT, S99TLYQ-HG-AB, S99TLYQ-B and Poshilo Makai-1 were found superior for grain yield Genotype across years and locations.
- Superior varieties in CVT should be further tested in CFFT and superior varieties in CFFT should be forwarded for release and be recommended to farmers of hill districts of Nepal for general cultivation

2.1.6 Development of drought tolerant maize varieties for Terai and mid hills of Nepal.

The objective of this project is to identify drought tolerant maize Genotype and to screen out adaptive maize Genotype for potential threat of climate change.

2.1.6.1 Coordinated Varietal Trial (CVT) on Drought Tolerant Maize2071/72

This is multi location trial , altogether 12 Genotype including CIMMYT Drought Tolerant material were tested under CVT-DTM at NMRP, Rampur, RARS, Nepalganj, ARS, Surkhet and RARS, Doti during spring, 2071/72. The experiment was designed in RCBD with three replications. Plot size was 4 rows of 4 meter long providing 75 cm × 25 cm row to row and plant to plant spacing. Evaluation of Genotype at two terminal drought stress (flowering and grain filling) period and stress environment was created through cut off irrigation 15 days before flowering.

The results of CVT- Drought tolerant maize at NMRP Rampur during 2071/72 were statistically highly significant on days to tasseling, silking, and significant on plant height, grain yield and 1000 grain yield e×cept ear height.

Table 31. Results of CVT- Drought Tolerant Genotype at NMRP, Rampur during 2071/72

S. No	Genotype	Days to 50% Tasseling	Days to 50% Silking	Plant height (cm)	Ear height (cm)	Grain Yield (kg/ha)	1000 Grain wt (gm)
1	Entry#22	53.67	56.67	171.7	93.3	3075.	320.0
2	Entry#25	53.33	56.00	156.7	80.0	3888.	354.7
3	Entry#26	54.67	57.00	150.0	80.0	3452.	337.3
4	Entry#27	54.67	57.00	173.3	93.3	4311.	336.0
5	Entry#28	57.00	59.67	173.3	95.0	4306.	328.0
6	Entry#32	56.67	59.33	191.7	113.3	3918.	408.0
7	Entry#36	58.0	60.33	175.0	90.0	4080	329.3
8	Entry#37	55.67	58.00	176.7	96.7	4978.	338.7
9	Entry#38	57.67	60.33	163.3	96.7	4517.	341.3
10	R POP 3	55.67	57.67	168.3	98.3	4747.	378.7
11	Rampur So3Fo8	56.33	59.00	170.0	95.0	5205.	370.7
12	TLBRSO7F16	57.00	59.67	168.3	95.0	4310.	402.7
	Mean	55.9	58.39	169.9	93.9	4232	353.8
	F-test	0.001	0.001	0.025	0.072	0.025	0.015
	$LSD_{0.05}$	1.471	1.791	18.73	17.62	1096.5	50.64
	CV%	1.6	1.8	6.5	11.1	15.3	8.5

Grain Yield:

The highest grain yield was obtained from the Genotype; Rampur So3Fo8 (5205 kg/ha), followed by Entry # 37 (4978kg/ha), R POP 3 (4747 kg/ha), Entry # 38 (4517 kg/ha), Entry # 27 (4311 kg/ha), and TLBRSO7F16 (4310 kg/ha) in CVT- DTM at NMRP, Rampur, during spring 2071.

On the basis of grain yield, superior selected Genotype were; Rampur So3Fo8, Entry#37, Rampur pop, and Entry # 38, Entry # 27 ,Entry # 28 and TLBRSO7F16 which yielded more than 4 ton/ha. Other CIMMYT DTM materials were Entry #32, Entry # 25, 26 and Entry # 22 which were yielded more than 3 tons /ha (Table 31).

2.1.6.2 Initial Yield Trial on Drought Tolerant Maize (IYT-DTM)

Altogether 20 Genotype including CIMMYT Drought Tolerant material were tested under IYT-DTM at NMRP, Rampur, RARS, Nepalganj, ARS, Surkhet and RARS, Doti during spring, 2070/71. The experiment was designed in alpha lattice with two replications. Plot size was 4 rows of 4 meter long providing 75 cm × 25 cm row to row and plant to plant spacing. Evaluation of Genotype at two terminal drought stress (flowering and grain filling) period and stress environment was created through cut off irrigation 15 days before flowering.

Results

NMRP Rampur

Table 32. Results of Drought Tolerant Genotype at NMRP, Rampur during Spring 2070/71.

S.N.	Genotype	Daysto 50% Tasseling	Daysto 50% Silking	Plant Ht (cm)	Ear Ht (cm)	1000 grain wt (gm)	Grain Yield kg/ha	Rank
1	Entry#21	57.0	60	160	75	300	2743	9
2	Entry#22	54.0	57	175	110	270	3113	6
3	Entry#23	58	61.5	175	95	346	1414	
4	Entry#24	57.5	61	177.5	90	348	1812	
5	Entry#25	55.5	57.5	170	72.5	360	2487	10
6	Entry#26	56.0	58.5	150	75	350	2145	
7	Entry#27	57	60.5	187.5	85	356	2386	
8	Entry#28	58	61.5	165	90	320	3495	2
9	Entry#29	57	59	165	75	332	3024	8
10	Entry#30	58.5	62	162.5	90	360	1982	
11	Entry#32	62	68	157.5	95	356	2248	
12	Entry#33	59	63.5	180	100	338	1999	
13	Entry#34	61	64.5	160	84	326	1586	
14	Entry#35	59	62	167.5	100	342	2150	
15	Entry#36	61.5	65.5	170	83	370	3174	5
16	Entry#37	59.5	64	142.5	75	342	3539	1
17	Entry#38	60.5	63	165	85	316	2301	
18	TLBRS07F16	59.5	62	172.5	110	400	3419	4
19	R POP3	60	63	150	95	294	3111	7
20	RampurSo3Fo8	58	63.5	160	80	314	3450	3
	Mean	58.45	61.9	165.6	88.2	337	2578	
	F-test	**	**	Ns	*	*	Ns	
	$LSD_{0.05}$	3.409	4.53	29.33	23.04	58.68	2303.8	
	CV%	2.8	3.5	8.5	12.5	8.3	28.7	

The results of IYT -DTM at Rampur were found statistically highly significant for days to 50 % tasseling, days to 50 % silking, Significant for ear height and 1000 grain weight but no significant for plant height and grain yield. However, the highest grain yield was found in genotype DTM Entry#37 (3539 kg/ha) followed by Entry # 28(3495 kg/ha), Rampur So3Fo8 (3450 kg/ha) and TLBRS07F16 (3419 kg/ha)

ARS Surkhet

The experiment result shows that there was no significant difference on days to 50% tasseling, silking, plant and ear height, grain yield and 1000 grain weight. However, among the tested 20 drought tolerant Genotype the highest grain yield was obtained from DTM Entry#35(6025 kg/ha) followed by Entry # 25 (5783 kg/ha), Entry # 22 (5690 kg/h), and Entry # 21 (5205 kg/ha) respectively.

Table 33. Results of IYT- Drought Tolerant Genotype at ARS, Surkhet during 2070/71

S. N.	Genotype	Daysto50% Tasseling	Daysto50% Silking	Plant height (cm)	Ear height (cm)	Grain Yield (kg/ha)
1	Entry#21	82.00	85.00	215.0	96.5	5205
2	Entry#22	81.50	85.00	219.0	112.0	5690
3	Entry#23	80.50	84.00	216.5	104.0	4644
4	Entry#24	80.00	84.00	203.0	83.0	4465
5	Entry#25	80.50	84.00	220.5	101.5	5783
6	Entry#26	81.00	84.50	196.0	89.0	4059
7	Entry#27	82.00	85.50	197.5	97.5	4036
8	Entry#28	82.00	85.00	191.0	90.5	4254
9	Entry#29	83.50	85.50	214.0	94.5	3984
10	Entry#30	81.50	84.50	214.5	102.5	3167
11	Entry#32	80.00	83.50	197.5	103.0	3909
12	Entry#33	80.00	83.00	192.5	86.5	3203
13	Entry#34	82.00	85.00	210.0	86.5	4355
14	Entry#35	80.5	84.00	198.0	92.5	6025
15	Entry#36	78.50	82.00	194.5	93.5	4190
16	Entry#37	79.00	82.50	178.5	74.0	3010
17	Entry#38	80.50	84.00	203.5	96.0	3376
18	TLBRS07F16	78.50	82.00	193.0	83.0	3541
19	R POP3	79.00	82.50	208.0	98.0	4579
20	RampurSo3Fo8	84.50	87.50	200.5	93.0	3048
	Mean	80.85	84.15	203.2	93.8	4226
	F-test	0.145	0.216	0.647	0.752	0.827
	$LSD_{0.05}$	3.638	3.323	36.18	30.48	3340.8
	CV%	2.1	1.9	8.5	15.5	27.8

RARS Nepalgunj

The results of IYT- DTM Genotype at Nepalganj during winter during 2070/71 were significant for plant height and non significant for 50 % days to tasseling, silking, ear height and grain yield.

Among the tested 20 drought tolerant Genotype Entry # 27 was found highest yielder (7942kg/ha) followed by Entry # 36 (6758 kg/ha), Entry # 23 (6750 kg/ha), RampurSo3Fo8 (6502 kg/ha) and TLBRS07F16 (6492 kg/ha)

Table 34. Results of IYT- Drought Tolerant Genotype at RARS, Nepalganj, Khajura Banke during 2070/71

S. No	Genotype	Daysto50% Tasseling	Daysto50% Silking	Plant height (cm)	Ear height (cm)	Grain Yield kg/ha
1	Entry#21	54.00	60.00	149.7	54.5	5043
2	Entry#22	56.50	61.50	144.1	47.3	5953
3	Entry#23	59.00	63.00	161.5	63.8	6750
4	Entry#24	62.00	67.00	141.6	53.8	2826
5	Entry#25	58.50	63.50	141.1	44.1	6369
6	Entry#26	59.50	64.50	131.0	48.0	5918
7	Entry#27	56.50	61.50	149.6	62.1	7942
8	Entry#28	59.50	64.00	147.6	52.3	5699
9	Entry#29	62.50	66.50	135.0	47.0	5732
10	Entry#30	58.50	64.00	155.1	60.7	5652
11	Entry#32	59.50	64.50	157.5	79.7	5700
12	Entry#33	59.00	64.00	153.9	61.2	4921
13	Entry#34	59.00	64.00	152.5	57.7	5919
14	Entry#35	60.00	65.00	165.5	58.5	6363
15	Entry#36	61.00	65.50	144.3	49.8	6758
16	Entry#37	60.50	66.00	141.1	51.1	5306
17	Entry#38	63.50	68.50	102.5	41.2	5602
18	TLBRS07F16	59.00	64.00	216.0	73.0	6492
19	R POP3	49.50	56.50	143.3	73.0	4669
20	RampurSo3Fo8	61.00	66.00	152.3	61.2	6502
	Mean	58.92	63.98	149.3	57.0	5806
	F-test	0.059	0.134	0.016	0.164	0.084
	$LSD_{0.05}$	0.343	6.052	36.46	23.97	2190.9
	CV%	5.1	4.5	11,7	20.1	18.0

Table 35. Average grain yield of IYT -Drought Tolerant Genotype at NMRP, Rampur, ARS, Surkhet and RARS, Nepalganj, Khajura Banke, during2070/71.

S. No	Genotype	Grain Yield kg/ha			Average Grain yield (Kg/ha) Across location
		NMRP, Rampur	ARS, Surkhet	RARS, Nepalganj	
1	Entry#21	2743	5205	5043	4330
2	Entry#22	3113	5690	5953	4919
3	Entry#23	1414	4644	6750	4269
4	Entry#24	1812	4465	2826	3034
5	Entry#25	2487	5783	6369	4880
6	Entry#26	2145	4059	5918	4041
7	Entry#27	2386	4036	7942	4788
8	Entry#28	3495	4254	5699	4483
9	Entry#29	3024	3984	5732	4247
10	Entry#30	1982	3167	5652	3600
11	Entry#32	2248	3909	5700	3952
12	Entry#33	1999	3203	4921	3374
13	Entry#34	1586	4355	5919	3953
14	Entry#35	2150	6025	6363	4846
15	Entry#36	3174	4190	6758	4707
16	Entry#37	3539	3010	5306	3952
17	Entry#38	2301	3376	5602	3760
18	TLBRS07F16	3419	3541	6492	4484
19	R POP3	3111	4579	4669	4120
20	RampurSo3Fo8	3450	3048	6502	4333
	Mean	2578	4226	5806	4203
	F-test	Ns	0.827	0.084	
	$LSD_{0.05}$	2303.8	3340.8	2190.9	
	CV%	29.7	27.8	18.0	

2.1.7 Development of Maize Varieties for Karnali Region

2.1.7.1 Coordinated Varietal Trial (CVT)-Karnali at ARS, Jumla (2071/72).

Ten maize Genotype (including Ganesh-1) during spring season of 20114 as CVT- Karnali region at ARS Jumla was tested in plot size of 4 rows of three meter length in randomized block design with three replications and plant spacing of 75 × 25 cm^2. These Genotype were KKT-03, MGU-08, KKT-Pop, MGU04, KKT-14, JML-34, KKT-01, Karnali Pool White, Ganesh-1 (check variety) and Farmer's Variety. All intercultural operations were carried out as per NMRP recommendations. The agronomical traits namely days to 50 % tasseling, days to 50% silking, plant height, ear height, and grain yield were recorded. Statistical analysis was done by Genstat program .

Table 36. Performance of maize Genotype on CVT- Karnali region at ARS Jumla during 2070/71

SN	Genotype	Days to 50% tasseling	Days to 50% silking	Plant height (cm)	Ear height (cm)	Husk Cover (1-5)	Grain Yield kg/ha)
1	KKT-03	136.0	142.33	175.8	53.9	2.33	2962
2	MGU-08	120.67	127.0	156.1	55.1	1.67	2520
3	KKT-Pop	136.0	142.0	177.8	66.7	2.33	3281
4	Karnali Pool White	125.33	131.33	172.8	63.5	3.67	5175
5	MGU-04	128.67	137.33	161.9	59.6	1.33	2918
6	KKT-14	122.67	130.33	180.7	70.3	2.00	3366
7	JML-34	121.67	128.00	171.1	59.3	3.33	4923
8	Ganesh-1	126.67	134.67	182.3	80.2	3.33	5684
9	KKT-01	119.33	125.00	185.8	69.1	2.33	4973
10	Farmers' local	119.33	124.67	186.5	69.5	3.33	3363
	Grand Mean	125.73	132.27	175.1	64.7	2.57	3897
	F-test	**	**	Ns	Ns	Ns	*
	$LSD_{0.05}$	8.503	9.36	26.44	16.48	2.278	2076.9
	CV,%	3.9	4.1	8.8	14.80	31.5	30.1

The results of CVT- Karnali at ARS, Jumla showed that the Genotype were found significant for grain yield. Other traits namely, days to 50% tasseling and silking was highly significant, but plant height and ear height were non significant. Grain yield ranged from 2520 kg/ha (MGU-08) to 5684 kg/ha (Ganesh-1). The grain yield was highest in Ganesh-1 followed by Karnali Pool White (5175kg/ha), KKT-01(4973 kg/ha), JML-34 (4923kg/ha), KKT-14

(3366kg/ha), and KKT Pop (3281 kg/ha), as compared to farmers local (3363 kg/ha) respectively (Table 36).

The highest grain yield was one of the basic criteria for identifying high yielding varieties. The Genotype Karnali Pool White, KKT-01, JML-34, and KKT-14, were found superior in their grain yield potentiality in Jumla district condition as compared to checks varieties. The genotype Ganesh-1 was found best in Jumla district in terms of grain yield. So these Genotype were found suitable Genotype for Karnali region.

2.1.8 Utilization of local land races for the development of varieties suitable for different production environment

2.1.8.1 Initial Yield Trial mid hill landraces (IYT-MHL) at HCRP, Kabre

Altogether 16 maize Genotype (including Manakamana-3, Rampur Composite and Farmer's Variety as standard and local checks) were tested at HCRP, Kabre Dolakha during main season of 2071/72 as IYT- Mid Hill Land races in plot size of 2 rows of three meter length in randomized block design with three replications and plant spacing of 75×25 cm^2. Fertilizers dose was 120: 60:40 kg/ha and 10 ton FYM as recommended. All intercultural operations were carried out as per NMRP recommendations. The agronomical traits namely days to 50 % tasseling, days to 50% silking, plant height, ear height, and grain yield were recorded. The experiments were conducted in different locations such as HCRP Kabre, ABD, Khumaltar, and RARS Lumle but only one location data has been presented infollowing table and data was analyzed by Genstat program and statistical analysis was done at 5% level of significance.

Table 37. Performance of maize Genotype on IYT on Mid Hill Land Races at HCRP, Kabre, Dolakha, during 2071/72

S. N.	Genotype	50% Flowering		Height (cm)		No/plot		Grain Yield kg/ ha
		male	female	plant	ear	plant	ear	
1	MHEW	66.50	70.00	120.0	96.5	15.00	19.50	3637
2	KLY Pop	68.50	71.50	167.5	118.0	14.50	20.00	4372.
3	HMLY	67.50	71.00	167.0	113.5	12.50	18.00	3478.
4	MHEY	66.50	69.50	146.0	114.5	14.00	14.00	2497.
5	MHPW-5	69.00	75.50	136.5	123.5	15.50	16.00	3633
6	MHPW-6	68.50	72.00	168.0	127.5	16.00	17.50	4273
7	MHPY-16	73.00	75.50	192.	133.0	14.00	18.00	3415
8	MHPW-16	70.50	73.00	137.0	126.5	16.00	18.00	2368.
9	KLW Pop	66.00	69.50	118.5	98.5	15.50	17.00	2605.
10	MHPW-36	67.50	71.00	141.5	103.5	14.50	13.50	3066.
11	MHPW-7	64.50	69.00	120.0	99.5	15.00	16.50	2834
12	KTG-12	71.00	73.50	155.5	130.0	15.50	18.00	3769.
13	RLP-7	73.00	76.00	169.0	133.0	15.00	16.00	3697.
14	R. Composite	71.50	76.50	148.0	110.5	16.00	17.00	4488
15	Manakamana-3	72.00	75.00	162.5	122.0	16.00	18.5	5281
16	Farmer's Variety	66.00	69.00	149.5	115.5	16.00	18.50	2672.
	Grand Mean	68.84	72.34	149.9	116.6	15.06	17.25	3505
	F-test	<.001	<.001	0.115	0.645	0.003	0.096	0.029
	$LSD_{0.05}$	3.323	2.884	45.57	40.80	1.403	3.753	1485.2
	CV%	2.3	1.9	14.3	16.4	4.4	10.2	19.9

Among the tested 16 Genotype on IYT- Mid hill land races, the Genotype; KLY Pop (4372 kg/ha.), MHPW-6 (4273 kg/ha), KTG-12 (3769 kg/ha), and RLP-7 (3697 kg/ha) were found best as compared to. R. Composite (4488 kg/ha) and Farmer's Variety (2672kg/ha)

2.1.8.2 Coordinated Varietal Trial (CVT) on High and Mid Hill landraces of maize

Altogether 10 maize Genotype combining both the high hills and Mid hill land races including Ganesh-1, were tested at NMRP, Rampur during winter season of 2071/72 as CVT in plot size of 4 rows of 4 meter length in randomized block design with replications and plant spacing of 75 × 25 cm^2. Fertilizers dose was 120: 60:40 kg/ha and 10 ton FYM as recommended. All intercultural operations were carried out as per NMRP recommendations. The agronomical traits namely days to 50 % tasseling, days to 50% silking, plant height, ear height, and grain yield were recorded and the data was analyzed by Genstat program and statistical analysis was done at 5% level of significance.

Table 38. Performance of maize Genotype combined of Karnali and Mid Hill landraces on CVT conducted at NMRP, Rampur during Spring 2071/72.

SN	Genotype	Days to 50% tasseling	Days to 50% silking	Plant height (cm)	Ear height (cm)	No of plants /plot	No of Ears/ plot	Grain Yield (kg/ha)
1	KKT-01	79.00	86.67	150.0	73.3	27.0	23.67	1908
2	KKT-POP	79.33	87.00	143.3	66.7	16.7	15.00	1713.
3	Karnali Pool yellow	86.00	91.33	160.0	76.7	22.3	20.33	2182.
4	Karnali Pool White	79.33	85.33	150.0	73.3	27.3	22.00	2042.
5	RLW-Pop	73.33	76.33	130.0	63.3	26.0	28.67	2150.
6	KEW-Pop	75.67	84.00	143.3	66.7	16.7	13.33	2008.
7	MHEY	75.33	82.33	143.3	76.7	27.7	26.33	2019
8	KEY	74.33	78.67	138.3	66.7	26.7	24.33	2165
9	MHPW-(7)	74.00	78.67	133.3	63.3	19.0	20.33	1838.
10	Ganesh-1	90.33	96.67	140.0	63.3	19.7	12.00	2265
Grand Mean		78.87	84.70	143.2	69.0	22.9	20.60	2029
F-test		<.001	<.001	0.130	0.736	0.141	0.007	0.976
$LSD_{0.05}$		3.631	3.453	19.06	20.0	10.13	8.486	982.4
CV %		2.5	2.4	7.8	16.9	25.8	24.0	28.2

Among the tested 10 Genotype; Karnali Pool yellow (2182 kg/ha, KEY (2165 kg/ha), RLW-Pop (2150 kg/ha),) and KEW-Pop (2008kg/ha.) were found superior in CVT at Rampur during winter, 2071 as compared to Ganesh-1.

2.1.9 Development of Open Pollinated Full Season Maize Varieties for Nepal

To identify high yielding open pollinated full season white and yellow maize varieties for Nepal, a series of trials such as IYT, CVT and CFFT of Hill set were carried out at Pakhribas, Kabre, Khumaltar, Lumle, Salyan and Dailekh during summer season of 2014. Similarly, IYT, CVT and CFFT of Terai set were carried out at Nepalgunj, Surkhet, Doti and Rampur. Randomized Complete Block Design with 3 replications was used for each trial. In IYT, there were two rows per plot. In CVT, there were four rows per plot. Length of rows was three meter. The row to row and plant to plant distances were 75 cm and 25 cm respectively. Other agronomic practices were conducted according to the recommended packages.

2.1.9.1 IYT Full season hill set combined analysis

The combined analysis of IYT full season hill set across Pakhribas, Khumaltar, Lumle and Dailekh showed that RAMPUR S10F22 produced the highest yield

(7388.92 kg/ha) followed by Manakamana-3 (7356.06 kg/ha) and R-POP-2 (7142.3 kg/ha) respectively (Table-39 and 40). Genotype werehighly significant for days to tasseling, days to silking, plant height and ear height. Genotype were significant for grain yield. Locations were highly significant for grain yield, days to tasseling, days to silking, plant height and ear height. Interactions were highly significant for grain yield and days to tasseling. Significant for days to silking but non significant for plant height and ear height.

2.1.9.2 CVT Full season hill set combined analysis

Combined analysis of CVT full season hill set showed that Manakamana-3 produced the highest yield (6287.66 kg/ha) followed by 07SADVI (5665.39 kg/ha) and Rampur S03F04 (5389.17 kg/ha) respectively (Table-41 and 42). Genotype and locations both are highly significant for plant height and ear height. Location was highly significant for grain yield and genotype was only significant for grain yield. Interaction was non-significant for grain yield, plant height and ear height.

Table 39. Yield (kg/ha)of different genotype on IYT (Hill set) at different NARC stations in 2014.

S. N.	Genotype	Dailekh	Khumaltar	Lumle	Pakhribas	Mean Grain Yield (kg/ha)
1	BLBSRS07F10	7994.67	6728.47	4243.79	5384.50	6087.86
2	DTM#35	5845.80	5628.76	4882.38	4157.00	5128.49
3	DTM#38	6988.86	4758.48	4543.04	5766.00	5514.10
4	Farmer's Variety	6254.59	5859.35	6261.46	5487.50	5965.72
5	HGA/HG-AB	8574.80	7440.73	3616.19	4505.00	6034.18
6	KLYPOP	8997.75	7899.82	5149.41	5665.00	6927.99
7	KSYN10	7988.08	9093.54	3445.92	6249.50	6694.26
8	KSYN12	10036.29	8579.87	1080.04	5513.50	6302.42
9	MANAKAMANA-3	8188.65	10126.12	4572.97	6536.50	7356.06
10	RAMPUR S10F18	10832.00	5881.83	5717.85	4923.50	6838.79
11	RAMPUR S10F20	7334.75	7314.61	3260.15	4790.00	5674.88
12	RAMPUR S10F22	11362.41	9360.94	2812.32	6020.00	7388.92
13	R-POP-2	8466.30	9854.33	4533.54	5715.00	7142.29
14	TLBRS07F14	9454.33	7841.05	4524.97	4971.00	6697.83

2.1.9.3 CFFT Full season hill set combined analysis

Combined analysis of CFFT full season hill set showed that Across 9942/Across 9944 produced the highest yield (5025.94 kg/ha) followed by Manakamana-3 (5025.5 kg/ha) and BGBYPOP (4976.87 kg/ha) respectively (Table-43 and 44).

Genotype and locations both were highly significant for grain yield, plant height and ear height. Interaction was highly significant for ear height but non-significant for grain yield and plant height.

2.1.9.4 IYT Full season terai set combined analysis

The combined analysis of IYT full season terai set across Nepalgunj, Doti and Rampur showed that R POP-4 produced the highest yield (5287.23 kg/ha) followed by CEL-0HGYA × CEL-0HGYB (5207.00 kg/ha) and R-POP-1 (4999.66 kg/ha) respectively (Table-45 and 46). Genotype and locations were highly significant for grain yield, days to tasseling, days to silking, plant height and ear height. Interactions were highly significant for grain yield and days to tasseling. Significant for days to silking but non significant for plant height and ear height.

Table 40. Combined analysis of IYT (Hill set) at different NARC stations in 2014

S.N.	Genotype	Grain Yield (kg/ha)	Days to Tasseling	Days to Silking	Plant Height (cm)	Ear Height (cm)
1	BLBSRS07F10	6087.86	63.50	66.38	231.10	125.38
2	DTM#35	5128.49	66.13	68.88	227.68	130.45
3	DTM#38	5514.10	67.13	69.75	214.48	113.48
4	Farmer's Variety	5965.72	61.25	64.25	251.53	142.54
5	HGA/HG-AB	6034.18	65.13	68.13	231.23	124.68
6	KLYPOP	6927.99	63.88	66.75	246.83	135.50
7	KSYN10	6694.26	66.75	69.88	234.48	127.65
8	KSYN12	6302.42	65.13	68.38	236.48	125.70
9	MANAKAMANA-3	7356.06	67.00	69.63	260.48	144.45
10	RAMPUR S10F18	6838.79	66.00	68.63	238.43	129.15
11	RAMPUR S10F20	5674.88	63.63	66.75	243.48	134.00
12	RAMPUR S10F22	7388.92	65.13	68.13	232.50	121.00
13	R-POP-2	7142.29	63.25	65.88	238.60	131.63
14	TLBRS07F14	6697.83	63.50	66.38	228.58	123.20
	F-Test (Gen)	*	**	**	**	**
	F-Test (Loc)	**	**	**	**	**
	F-Test (G × L)	**	**	*	ns	ns
	LSD (Gen)	1356.9	1.658	1.771	17.84	14.46
	LSD (Loc)	725.3	0.886	0.947	9.53	7.73
	LSD (G × L)	2713.7	3.316	3.543	-	-
	CV (%)	21.1	2.6	2.6	7.5	11.2

2.1.9.5 CVT Full season terai set combined analysis

Combined analysis of CVT full season terai set conducted at Doti, Surkhet and Rampur showed that Rampur S13 F24 produced the highest yield (3451.94 kg/ha) followed by TAKFA-S- 9536 (3236.17 kg/ha) and Rampur S13 F16 (3202.97 kg/ha) respectively (Table-47 and 48). Genotype and locations both are highly significant for grain yield, days to tasseling, days to silking, plant height and ear height. Interaction was highly significant for grain yield, days to tasseling, days to silking and ear height but non-significant for plant height.

Table 41. Yield (kg/ha) of different genotype on CVT (Hill set) at different NARC stations in 2014

S. N.	Genotype	Dailekh	Dolakha	Khumaltar	Lumle	Pakhribas	Salyan	Mean GY (kg/ha)
1	05SADVI	6719.18	5591.82	6794.04	1704.67	5437.67	5214.19	5243.59
2	07SADVI	6576.56	6153.98	7732.92	2574.36	5465.33	5489.19	5665.39
3	BLSBRS07F12	5579.99	6113.20	8122.14	2194.33	5789.00	3545.90	5224.09
4	FARMERS' LOCAL	5731.56	3927.62	6970.21	2723.68	4944.67	4358.59	4776.05
5	MANAKAMANA-3	7275.08	7168.77	9771.85	2724.75	6255.00	4530.47	6287.66
6	RAMPUR S03F04	5374.81	6391.47	8012.27	2519.36	6119.00	3918.08	5389.17
7	RAMPUR S03F08	5312.52	6092.77	6640.17	2014.83	5200.67	3372.03	4772.17
8	TLBRS07F16	4356.15	5970.95	9726.33	1925.38	4310.00	3352.75	4940.26
9	ZM-401	6466.58	6345.81	6696.92	2264.17	5312.33	4886.34	5328.69
10	ZM-627	6222.92	5221.85	7671.56	2008.61	4726.67	4779.61	5105.20

Table 42. Combined analysis of CVT (Hill set) at different NARC stations in 2014

S.N.	Genotype	Grain Yield (kg/ha)	Plant Height (cm)	Ear Height (cm)
1	05SADVI	5243.59	235.69	123.33
2	07SADVI	5665.39	223.69	117.59
3	BLSBRS07F12	5224.09	223.29	117.49
4	FARMERS' LOCAL	4776.05	258.09	144.33
5	MANAKAMANA-3	6287.66	259.10	142.49
6	RAMPUR S03F04	5389.17	219.89	116.53
7	RAMPUR S03F08	4772.17	223.58	123.50
8	TLBRS07F16	4940.26	216.43	120.13
9	ZM-401	5328.69	224.29	114.81
10	ZM-627	5105.20	216.20	114.41
	F-Test (Gen)	*	**	**
	F-Test (Loc)	**	**	**
	F-Test (G × L)	ns	ns	ns
	LSD (Gen)	789.6	12.23	9.31
	LSD (Loc)	611.6	9.48	7.21
	LSD (G × L)	-	-	-
	CV %	22.7	8.1	11.4

Table 43. Yield of different genotype on CFFT (Hill set) at different NARC stations in 2014.

S.N.	Genotype	Lumle	Pakhribas	Salyan	Grand Total
1	Across 9942/Across 9944	4954.45	4829.67	5293.71	5025.94
2	BGBYPOP	4082.05	5192.33	5656.24	4976.87
3	Farmer's Variety	3059.06	4557.00	5078.98	4231.68
4	Manakamana-3	3893.68	4746.33	6436.49	5025.50
5	P501SRCO/P502SRCO	4121.77	4330.00	4036.02	4162.60
6	Rampur S03F06	3344.28	3721.00	3965.26	3676.85

Table 44. Combined analysis of CFFT (Hill set) at different NARC stations in 2014

S.N.	Genotype	Grain Yield (kg/ha)	Plant Height (cm)	Ear Height (cm)
1	Across 9942/Across 9944	5025.94	237.72	123.61
2	BGBYPOP	4976.87	233.17	122.78
3	Farmer's Variety	4231.68	278.33	181.83
4	Manakamana-3	5025.50	236.78	133.11
5	P501SRCO/P502SRCO	4162.60	250.06	136.11
6	Rampur S03F06	3676.85	224.78	119.00
	F-Test (Gen)	**	**	**
	F-Test (Loc)	**	**	**
	F-Test (G × L)	ns	ns	**
	LSD (Gen)	755.5	25.15	16.79
	LSD (Loc)	534.2	17.79	11.87
	LSD (G × L)	-	-	29.08
	CV %	17.5	10.8	12.9

2.1.9.6 CFFT Full season terai set combined analysis

Combined analysis of CFFT full season terai set conducted at Doti and Rampur showed that Across 9331 RE produced the highest yield (5328.16 kg/ha) followed by HG-AB (3785.72 kg/ha) and HG-A (3389.47 kg/ha) respectively (Table-49 and 50). Genotype, locations and interaction were highly significant for grain yield, days to tasseling, days to silking, plant height and ear height.

Table 45. Yield (kg/ha) of different genotype on IYT (Terai set) at different NARC stations in 2014

S.N.	Genotype	DOTI	NEPALGUNJ	RAMPUR	Mean GY (kg/ha)
1	AGUA FRIA S 0031	7914.00	4397.55	2035.61	4782.39
2	CEL-0HGYA × CEL-0HGYB	8410.00	3878.59	3332.42	5207.00
3	Farmers Var.	3805.00	3757.87	2067.13	3210.00
4	PHRA PHUTTABAT- S0031	2070.00	1075.86	147.02	1097.63
5	POZARICA-S 9627 (RE)	2594.50	774.12	173.53	1180.72
6	R Composite	5595.00	3344.82	2066.90	3668.90
7	R POP-1	8810.50	2331.86	3856.61	4999.66
8	R POP-2	6109.50	1572.52	2343.46	3341.83
9	R POP-3	6469.50	4334.56	2552.71	4452.26
10	R POP-4	7146.00	5238.56	3477.12	5287.23
11	RAMPUR S03 F06	5138.50	2762.04	529.30	2809.95
12	RAMPUR S03 F08	6266.00	994.42	190.75	2483.72
13	RAMPUR S03F02	2443.50	210.16	153.55	935.74
14	S 0128	6252.50	1659.38	292.26	2734.71

Table 46. Combined analysis of IYT (Terai set) at different NARC stations in 2014

S. N.	Genotype	Grain Yield (kg/ha)	Days to Tasseling	Days to Silking	Plant Height (cm)	Ear Height cm)
1	AGUA FRIA S 0031	4782.39	67.83	72.33	185.90	75.27
2	CEL-0HGYA × CEL-0HGYB	5207.00	72.17	75.67	175.33	78.53
3	Farmers Var.	3210.00	61.00	65.67	207.63	101.60
4	PHRA PHUTTABAT- S0031	1097.63	71.00	74.33	144.01	68.05
5	POZARICA-S 9627 (RE)	1180.72	71.00	74.00	162.23	58.23
6	R Composite	3668.90	69.17	73.17	175.90	85.80
7	R POP-1	4999.66	69.50	74.00	181.10	85.87
8	R POP-2	3341.83	68.00	73.00	180.07	83.47
9	R POP-3	4452.26	69.67	73.83	180.73	94.27
10	R POP-4	5287.23	69.00	73.00	204.30	97.70
11	RAMPUR S03 F06	2809.95	69.33	72.33	190.07	89.20
12	RAMPUR S03 F08	2483.72	72.00	75.83	157.23	72.90
13	RAMPUR S03 F02	935.74	72.50	77.00	145.83	59.75
14	S 0128	2734.71	71.33	75.50	178.17	81.47
	F-Test (Gen)	**	**	**	**	**
	F-Test (Loc)	**	**	**	**	**
	F-Test (G × L)	**	**	*	ns	ns
	LSD (Gen)	1045	2.898	3.179	28.56	16.16
	LSD (Loc)	483.7	1.341	1.472	13.22	7.48
	LSD (G × L)	1809.9	5.019	5.506	-	-
	CV %	27.2	3.6	3.7	13.9	17.1

Table 47. Yield (kg/ha) of different genotype on CVT (Terai set) at different NARC stations in 2014

S.N.	Genotype	DOTI	RAMPUR	SURKHET	Mean GY (kg/ha)
1	ACROSS 9331 RE	5406.33	1974.63	2177.90	3186.29
2	FS' LOC. CHECK	2279.00	3535.25	1671.26	2495.17
3	POZARICA 9531	3337.67	2780.62	1839.97	2652.75
4	R.COMP. (ST.CHK.)	5028.33	1117.74	2701.76	2949.28
5	Rampur S 13 F 24	6622.33	1248.32	2485.18	3451.94
6	Rampur S 13 F 26	5815.67	1021.67	2771.58	3202.97
7	S97TLYGH "AyB" (3)	2156.67	1418.18	180.77	1251.87
8	SIN-IBP-UTYF	4933.67	1291.99	1801.68	2675.78
9	TAKFA-S- 9536	5443.67	2177.79	2087.04	3236.17
10	TERAI POOL YELLOW	4989.33	1363.02	1348.27	2566.87

Table 48. Combined analysis of CVT (Terai set) at different NARC stations in 2014

S. N.	Genotype	Grain Yield (kg/ha)	Days to Tasseling	Days to Silking	Plant Height (cm)	Ear Height (cm)
1	ACROSS 9331 RE	3186.29	62.89	67.33	192.11	96.67
2	FS' LOC. CHECK	2495.17	63.78	66.89	191.56	80.00
3	POZARICA 9531	2652.75	67.00	69.78	180.11	81.00
4	R.COMP. (ST.CHK.)	2949.28	66.78	70.78	206.67	101.89
5	Rampur S 13 F 24	3451.94	68.56	72.44	211.22	94.11
6	Rampur S 13 F 26	3202.97	66.56	69.89	191.89	92.56
7	S97TLYGH "AyB" (3)	1251.87	68.00	70.33	180.11	84.78
8	SIN-IBP-UTYF	2675.78	69.11	71.78	204.56	94.89
9	TAKFA-S- 9536	3236.17	69.33	72.33	191.11	92.11
10	TERAI POOL YELLOW	2566.87	66.33	69.44	184.11	97.56
	F-Test (Gen)	**	**	**	**	**
	F-Test (Loc)	**	**	**	**	**
	F-Test (G × L)	**	**	**	ns	**
	LSD (Gen)	867	1.666	2.014	14.45	9.17
	LSD (Loc)	474.8	0.912	1.103	7.92	5.02
	LSD (G × L)	1501.6	2.885	3.488	-	15.89
	CV %	33.2	2.6	3.0	7.9	10.6

Table 49. Yield (kg/ha) of different genotype on CFFT (Terai set) at different NARC stations in 2014

S.N.	Genotype	DOTI	RAMPUR	Mean Yield
1	Across 9331 RE	5495.00	5161.31	5328.16
2	Farmers Variety	4823.50	621.59	2722.54
3	HG-A	3296.00	3482.94	3389.47
4	HG-B	3822.50	917.78	2370.14
5	HG-AB	4088.50	3482.94	3785.72
6	Narayani	3727.50	460.59	2094.05
7	Upahar	4550.00	621.59	2585.79

Table 50. Combined analysis of CFFT (Terai set) at different NARC stations in 2014

S.N.	Genotype	Grain Yield (kg/ha)	Days to tasseling	Days to silking	Plant Height (cm)	Ear Height (cm)
1	Across 9331 RE	5328.16	84.75	88.25	189.25	88.25
2	Farmers Variety	2722.54	87.25	90.50	214.25	101.00
3	HG-A	3389.47	84.75	88.25	187.75	82.00
4	HG-B	2370.14	84.00	88.00	197.75	98.00
5	HG-AB	3785.72	84.50	87.75	184.00	83.25
6	Narayani	2094.05	84.50	88.25	177.00	76.75
7	Upahar	2585.79	86.75	89.25	174.00	65.75
	F-Test (Gen)	**	**	**	**	**
	F-Test (Loc)	**	**	**	**	**
	F-Test (G × L)	**	**	**	**	**
	LSD (Gen)	1167.3	1.396	0.923	5.897	6.280
	LSD (Loc)	623.9	0.746	0.494	3.152	3.357
	LSD (G × L)	1650.8	1.974	1.306	8.339	8.881
	CV %	24	1.1	0.7	2.0	4.8

2.1.10 Maintenance of released maize varieties

For the maintenance of released maize varieties, in first year, we conducted grid selection and in the second year, we conducted half sib family selection. In grid selection, we prepared 100 grids and selection of 6 ears was done in each grid. In each grid, there were 6 rows and from each row one ear was selected. Length and width of each grid was 5m and 4.5m respectively. In half sib family selection, male and female lines were planted in 1:3 ratio. Male lines were prepared by bulking seeds of all ears and each selected ears were used as female line. After crossing, selected ears of the female lines were bulked to make nucleus seed.

Grid selection was completed in Arun-2, Manakamana-3 and Poshilo Makai-1. Half sib family selection was completed in Rampur Composite and Deuti and 5 kg and 4 kg nucleus seed was produced in those varieties respectively.

2.2 Agronomy

2.2.1 Studies on the performance of different tillage methods, residue levels and cropping systems in upland of Terai, Nepal

In order to find out the effect of different tillage methods, residue management methods under various maize based cropping systems in the upland, an experiment was conducted during 2014 at Rampur, Chitwan. Experiment was laid out in strip plot design with tillage as vertical factor, residue as horizontal factor and cropping systems as split plots. Each factor were tested at two levels i.e tillage (conventional tillage and no tillage), residue (residue kept and removed) and cropping system (Maize sole followed by wheat and maize + soybean followed by wheat). Rest of the crop management practices except dictated by treatments were managed as per the recommended crop management practices. Manakamana-3, Puja and Vijaya were the varieties of maize, soybean and wheat used for the experiment. Observations were recorded for soil properties, crop growth, individual crop yields and yield contributing traits, system yield and economics of production.

Results

System yield was significantly affected by different tillage methods and the highest value of 17412.7 kg/ha was recorded in zero tilled and residue kept plot intercropped with soybean during summer followed by wheat during winter (Table 51). The lowest system yield (11,770.7 kg/ha) was recorded in no tilled and residue removed plot without soybean intercropping followed by wheat, conventionally tilled and residue removed plot with no soybean followed by wheat and no tilled without residue and soybean intercropping followed by wheat.

Table 51. System yield of maize, soybean and wheat under different treatment combinations, Rampur, Chitwan, 2014

Treatments	System yield (kg/ha)
Conventional tillage with residue removed + sole maize – wheat	11854.8
Conventional tillage with residue removed + maize with soybean-wheat	16193.2
Conventional tillage with residue kept + sole maize-wheat	12081.0
Conventional tillage with residue kept + maize with soybean-wheat	17144.0
No till with residue removed+ sole maize-wheat	11770.7
No till with residue removed+ maize with soybean-wheat	16498.5
No till with residue kept+ sole maize-wheat	12291.9
No till with residue kept+ maize with soybean-wheat	17412.7
F test	***
$LSD_{0.05}$	1824.0
CV %	7.2
Grand mean	14381

Tillage and residue did not affect the system yields of maize-wheat system in Terai of Nepal. But the variation was evident due to residue levels and the highest system yield (16763.0 kg/ha) was found in maize+ soybean-wheat as against the lowest yield of 12000.0 kg/ha in maize sole-wheat (Table 52).

Soil properties

The bench mark soil sample analysis carried out before the inception of the experiment reported that the soil pH, soil organic matter, N, P_2O_5 and K_2O were 5.3, 3.4%, 0.163%, 32.5 and 77.8 kg/ha.

Soil pH

ANOVA of the post harvest soil sample analysis after three seasons of experimentation revealed that, pH was only affected by residue and was not affected by tillage and cropping systems. Plots with residue left had lower pH value of 5.90 as against the 5.95 in residue removed.

Table 52. Effect of tillage methods, residue levels and cropping systems in system yields of maize, soybean and wheat and soil properties, Rampur, 2072

Treatment	System yield (kg/ha)	pH	Soil organic matter	N %	P_2O_5 (kg/ha)	K_2O (kg/ha)
Tillage methods (T)						
Conventional tillage	14283.0	5.93	3.608	0.169	32.59	77.73
No tillage	14480.0	5.92	3.618	0.168	33.26	78.05
F test	NS	NS	NS	NS	*	NS
$LSD_{0.05}$	-	-	-	-	0.621	-
Residue management (R)						
Residue removed	14172.0	5.95	3.496	0.168	32.83	78.01
Residue kept	14591.0	5.90	3.730	0.169	33.02	77.76
F test	NS	**	**	NS	NS	NS
$LSD_{0.05}$	-	0.038	0.017	-	-	-
Cropping system (CS)						
Maize-wheat	12000.0	5.92	3.567	0.165	32.84	77.89
Maize+ Soybean-Wheat	16763.0	5.93	3.659	0.172	33.02	77.88
F test	**	NS	**	*	NS	NS
$LSD_{0.05}$	912.0	-	0.017	0.001	-	-
CV,%	7.2	0.7	0.5	0.9	2.2	1.0
Grand mean	14381	5.93	3.613	0.168	32.93	77.89
RxCS	-	-	-	0.001	-	-

Soil organic matter

Soil organic matter was also affected by residue levels and cropping systems. Residue kept field had higher SOM (3.730 %) as compared to residue removed (3.496%). A field planted with maize and soybean followed by wheat had the highest value of SOM (3.659 %) over the field with sole maize followed by wheat with 3.567 % (Table 52).

Soil total nitrogen

Soil nitrogen however was not affected by tillage and residue levels, but was affected by cropping system. A field planted with maize and soybean followed by wheat had the highest value of nitrogen (0.172%) over the field with sole maize followed by wheat with 0.165% (Table 52).

Soil available phosphorus

ANOVA revealed that the soil available phosphorus was only affected by tillage methods and the higher value of 33.26 kg/ha was in NT over 32.59 kg/ha in CT. Residue levels and cropping systems did not influence the soil available phosphorus (Table 52).

Soil available potassium

No variation was observed for soil available potassium content due to tillage, residue levels and cropping systems (Table 52).

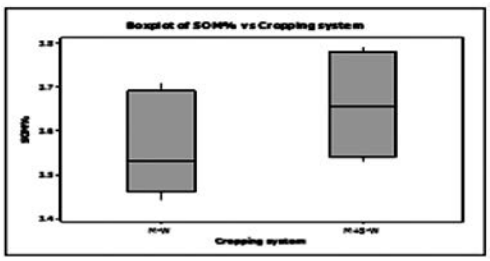


Fig 1. Effect of cropping system on SOM (%)

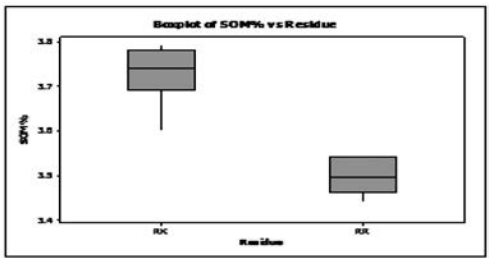


Fig 2. Effect of residue levels on SOM (%)

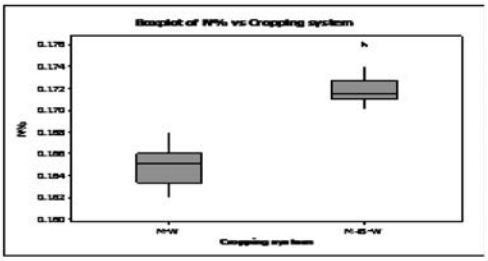


Fig 3. Effect of cropping system on soil nitrogen (%)

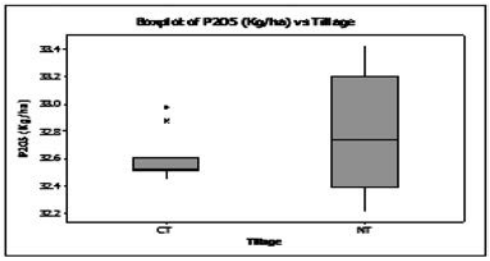


Fig 4. Effect of tillage on available soil P_2O_5

2.2.2 Evaluating the of conservation agriculture-based crop management practices under rice-maize system in Terai, 2014

A conservation agriculture based experiment having four factors each with two levels i.e tillage (no tillage and conventional tillage), residue levels (kept and removed), nutrient (recommended doses of nutrients i.e 120 : 60 : 40 NPK kg/ ha in maize and 100 : 30 : 30 NPK kg/ha in rice and farmers practice of 10 t FYM + 70:30:50 NPK kg/ ha in maize and 10 t FYM + 50:20:0 NPK kg / ha in rice) and weed management (manual as farmers practice and herbicide : atrazine @1.5 kg ai/ha for maize and pendimethalin @1 kg ai/ha for rice as pre-emergence applications) were tested under strip-split design in Rampur, Chitwan for maize during winter and for rice during summer season, 2071. Individual plot size was 34.02 m^2. Rampur-hybrid-2 and Ram dhan were the genotype used for maize and rice in the experiment. Observations were recorded for soil properties, crop growth and grain yield along with yield contributing traits of both the crops.

2.2.2.1 Maize

Number of ears per hectare

Total number of ears harvested per hectare was one of the most important parameters in determining the grain yield of crop. Number of ears per hectare was significantly affected by tillage, residue levels and nutrient management, while effect of weed management was not obvious (Table 53). Number of ears per hectare under no tillage was found significantly highest (54,941) as compared to conventional tillage (51,651). Similarly, significantly higher number of ear per hectare was recorded under residue kept plot compared to residue removed plot. In case of nutrient management, application of scientifically recommended dose produced significantly higher number of ears per hectare compared to use of farmer's dose.

Grains per cob

Number of grains per cob was significantly affected by tillage, residue levels and nutrient management (Table 53). Number of grains per cob found to have significantly higher under no tillage (315.4), residue kept (329.1) and recommended dose of nutrient (415.2) in comparison to conventional tillage (301.8), residue removed (288.0) and farmer's dose of nutrient (202.0) respectively.

Thousand grain weight (gm)

Thousand grain weight of maize was significantly influenced by tillage, residue levels, nutrient management and weed management. It was obtained significantly higher in no tillage (250.45 gm) and residue kept (254.46 gm)

in comparison to conventional tillage (243.10 gm) and residue removed (239.08 gm) respectively. Application of recommended dose of nutrient and herbicide produced maximum grain weight of maize (249.54 gm and 254.67 gm respectively).

Table 53. Effect of tillage, residue levels, nutrient management and weed management on yield and yield attributing characters of maize, 2014

Treatments	No of ears (000) ha^{-1}	Grains per cob	Thousand grain weight (gm)	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index
Tillage						
Conventional Tillage	51651	301.8	243.10	4274	5062	45.78
No Tillage	54941	315.4	250.45	4545	4774	48.77
SEm±	551.5	4.01	0.637	73.3	88.6	0.190
F-test	***	*	***	**	*	Ns
$LSD_{0.05}$	1592.9	11.58	1.841	211.6	255.8	-
Residue Levels						
Residue removed	46324	288.0	239.08	3432	3853	46.13
Residue kept	60268	329.1	254.46	5387	5982	46.93
SEm±	1125.8	8.19	1.301	149.6	180.8	0.389
F-test	***	**	***	***	***	Ns
$LSD_{0.05}$	3251.5	23.64	3.757	432	522.2	-
Nutrient Management						
Farmer Dose	42989	202.0	244.00	2175	2589	45.28
Recommended Dose	63602	415.2	249.54	6644	7247	47.79
SEm±	503.5	3.66	0.582	66.9	80.9	0.174
F-test	***	***	***	***	***	***
$LSD_{0.05}$	1454.1	10.57	1.680	193.2	233.5	0.502
Weed Management						
Manual Weeding	52864	304.0	238.87	4139	4622	46.47
Pre-emergence herbicide used	53728	313.2	254.67	4680	5213	46.60
SEm±	581.3	4.23	0.672	77.2	93.4	0.201
F-test	Ns	Ns	***	***	***	Ns
$LSD_{0.05}$			1.940	223.1	269.7	
CV%	4.6	5.8	1.2	7.4	8.1	1.8
Grand mean	53296	308.6	246.77	4409	4918	46.53

Grain yield

Tillage methods, residue levels and nutrient management had a significant effect on grain yield (Table 53). Among tillage treatments, no tillage performed better for grain yield with 4545 kg/ha. Similarly, grain yield under retained residues, recommended dose of nutrient and application of herbicide was found significantly higher (5982, 6644 and 4680 kg/ha respectively) over residue removed, farmers doses of nutrients and manual weeding.

Stover yield

Tillage methods, residue levels and nutrient management affected significantly the grain and stover yields. Similarly, stover yields under conventional tillage (5062 kg/ha), residue retained (5982 kg/ha), recommended dose of nutrients (7247 kg/ha) and application of pre-emergence herbicide (5213 kg/ha) was found to be superior over no tillage (4774), residue removed (3853), farmers' doses of nutrients (2589) and manual weeding (4622 kg/ha) respectively (Table 53).

Harvest index

ANOVA revealed that the harvest index of maize was significantly affected only by nutrient management, while the rest of the treatments the tillage, residue levels and weed management did not affect the harvest index (Table 53). Application of recommended dose of nutrient produced significantly the higher harvest index (47.79%) as compared to application of farmer's dose of nutrient (45.28%).

2.2.2.2 Rice

Panicle length

Panicle length of rice was significantly influenced by only nutrient levels (Table 54). Application of recommended dose of fertilizer produced the higher panicle length of 27. 32 cm compared to farmer dose of fertilizer having 21.97 cm. However, tillage methods, residue levels and weed management methods did not affect the panicle length of rice.

Sterile spikelet per panicle

Analysis of data showed that tillage, residue levels, nutrient management and weed management treatments had non-significant influence on the number of sterile spikelet per panicle (Table 54).

Thousand grain weight

Thousand grain weight of rice was significantly affected by residue levels and nutrient management (Table 54). The weight under residue kept and recommended dose of fertilizer was found significantly higher with 19.45 and 20.09 gm respectively, as compared to residue removed and farmers' doses of fertilizer having 18.81 and 18.17 gm respectively. But the tillage and weed management methods had no effect on test weight of rice.

Number of effective tillers per m^2

Tiller number per unit area was significantly affected only by residue levels and nutrient levels. Tillers number per m^2 under residue kept and recommended dose of fertilizer was found significantly higher (155.6 and 212 respectively) as compared to residue removed and farmers dose of fertilizer (145.0 and 88 respectively). Tillage and weed management had non significant effect on tillers number per m^2 (Table 54).

Total no of grains per panicle

Similarly, tillage methods, residue levels and nutrient management had significant effect on number of grains per panicle (Table 54). Grains per panicle under no till, residue kept and recommended dose of fertilizer was found significantly higher of 137.2, 131.3 and 163.7 as compared to residue removed and farmers' dose of fertilizer having 104.0, 109.9 and 77.5. Tillage and weed management had non- significant effect on number of grains per panicle.

Grain yield (kg ha^{-1})

Grain yield was significantly affected by residue levels and nutrient management (Table 54). Grain yield under residue kept and recommended dose of fertilizer was found significantly higher with 3633.22, 3665.88 and 5851.01 kg ha-1 respectively as compared to conventional tillage, residue removed and farmers' dose of fertilizer having 3254.31, 3223.98 and 1037.4 kg ha^{-1} respectively. However, tillage and weed management methods did not affect on grain yield.

Interactions

Interactions of tillage and residue for the number of grains per panicle and grain yield per hectare were found to be significant. It revealed that tillage with or without residue affected the number of grains per panicle and grain yield of rice, indicating the positive effect of no tillage i.e direct seeding method of rice under residue retention over conventional tillage with no residue. However, the thousand grain weight of rice was found significant with different levels of residue and nutrients. Plots with residue kept and higher doses of nutrients might have additive effect on the weight of rice grain (Table 54).

Table 54. Effect of tillage, residue levels, nutrient management and weed management on yield and yield attributing characters of rice, 2014

Treatment	Panicle length (cm)	Sterile spikelet/ panicle	Thousand grain weight (gm)	No of branches/ panicle	No of effective tillers m^{-2}	No of grains /panicle	Grain yield (kg/ha)
Tillage methods							
Conventional Tillage	25.01	7.69	19.11	10.85	150.7	104.0	3254.31 .
No Tillage	24.28	6.19	19.15	14.1	149.9	137.2	3633.22
F-test	NS	NS	NS	NS	NS	*	*
LSD (5 %)	-	-	-	-	-	9.94	268.0
Residue Levels							
Residue removed	24.5	7.62	18.81	11.58	145.0	109.9	3223.98
Residue kept	24.79	6.25	19.45	13.38	155.6	131.3	3665.88
F-test	NS	NS	**	NS	**	**	**
LSD (5 %)	-	-	0.477	-	7.45	5.74	154.7
Nutrient Management							
Farmer Dose	21.97	7.42	18.17	10.17	88	77.5	1037.4
Recommended Dose	27.32	6.46	20.09	14.79	212	163.7	5851.01
F-test	**	NS	*	**	**	**	**
LSD (5 %)	0.627	-	0.477	2.129	7.45	5.74	154.7
Weed Management							
Manual Weeding	24.72	6.58	19.16	12.12	149.6	120.8	3445.47
Herbicide	24.57	7.29	19.09	12.83	151	120.4	3442.12
F-test	NS	NS	NS	NS	NS	NS	NS
LSD (5 %)	-	-	-	-	-	-	-
CV,%	4.3	34.1	4.2	28.04	8.4	8.1	7.6
Grand mean	24.64	6.94	19.13	12.48	150.3	120.6	3444.15

Treatment	Panicle length (cm)	Sterile spikelet/ panicle	Thousand grain weight (gm)	No of branches/ panicle	No of effective tillers m^{-2}	No of grains /panicle	Grain yield (kg/ha)
Interactions							
TxR						*	
TxN						11.48	*
RxN			*				309.5
LSD			0.675				
TxRxN							*
LSD							387.4

Soil organic matter (%)

Tillage methods and residue levels affected the soil organic matter after the harvest of the crop. NT had the higher SOM of 2.96% compared to conventional tillage methods (2.953). Similarly, residue kept plot had higher SOM (3.194%) over residue removed (2.724) (Table 55).

Table 55. Effect of different tillage methods, residue levels, nutrient levels and weed management methods on soil organic matter (SOM) content after the harvest of rice, 2014

Treatment	SOM (%)
Tillage methods	
Conventional tillage	2.953
No tillage	2.966
F-test	**
$LSD_{0.05}$	
Residue levels	
Residue kept	3.194
Residue removed	2.724
F test	**
$LSD_{0.05}$	
Nutrient levels	
Farmer's doses of nutrient	2.949
Recommended doses of nutrients	2.970
F test	**
$LSD_{0.05}$	
Weed management	
Herbicide	2.961
Manual	2.957
F test	NS
$LSD_{0.05}$	-
CV,%	0.5
Grand mean	2.959
Interactions	
TxR	**
TxN	**
RxN	**
$LSD_{0.05}$	0.012
TxRxN	**
$LSD_{0.05}$	0.017

2.2.3 Studies on the performance of maize hybrids under various tillage methods and plant densities in Terai Nepal, 2071

The experimental setup was laid out during winter season of 2014 and the field was laid out in strip plot design with three replications and 12 treatments. Maize crop was planted on 12th of February, 2014 and harvested on 27th of June, 2014. The vertical factor was tillage with no tillage (NT) and conventional tillage (CT) and the horizontal factor were genotype (Rampur Hybrid-2 and RML-32/ RML-17) and in split planting geometries (D1:75cm × 25cm =53,333 plants ha^{-1}, D2:70cm × 25cm=57,142 plants ha^{-1} and D3:60cm × 25cm= 66,666 plants ha^{-1}). The individual plot size was having 7 rows of 5 meter long as prescribed by the treatments. The three central rows were used as net plot rows for biometric and agronomical data recording and the remaining 2 rows leaving the two border rows at either side were used for biometrical and phenological observations. The crop was fertilized with 120:60:40 kg NPK ha^{-1}. Fifty % of the N along with full P and K was applied during seeding and remaining N was splitted into 2 and first half was applied at V7 stage and and the remaining N at pre-tasseling stageof maize. Rest of the crop management operations were done as per the treatment. Weather parameters were recorded from the NMRP's meteorological station. Soil texture, bulk density, organic matter content, pH, N, P and K were analyzed using the prescribed laboratory procedures.

RESULTS

No of plants and cobs per hectare

Tillage methods and genotype did not affect the no of plants per hectare, however was affected by different plant densities. Similarly, the number of cobs per hectare was also affected only by different planting geometries. Planting geometries of 65×25 cm apart had the highest number of cobs 67638/ ha followed by 57291 in 70×25cm and 53472 in 75×25 cm (Table 56).

Plant height

Significant effects of tillage and planting geometries on plant height of maize was observed. Conventional tillage had the highest plant height of 200.93 cm as against 182.17 cm in NT. Unlike the last year, the difference between the tested hybrids for plant height did not vary this year. Interestingly, the planting geometries affected the plant height of maize. Higher value of it was recorded in closely spaced plantings than widely spaced planting. Planting geometries of 65×25 cm apart had the highest plant height of 202.64cm followed by 189.71 cm in 70×25 cm and 182.29 cm and in 75×25 cm (Table 56).

Table 56. Effect of tillage, hybrids and planning densities on the crop performance of winter maize, Rampur, 2071/72

Treatment	No of plants/ ha	No of Cobs/ ha	Plant height (cm)	Ear height (cm)	Cob diameter (cm)	Cob length (cm)	Physio maturity (days)
Tillage methods							
CT	58379	59351	200.93	113.64	4.16	15.57	135.78
NT	58425	59583	182.17	114.58	3.89	13.92	131.94
F-test	NS	NS	*	NS	***	*	**
$LSD_{0.05}$	-	-	18.55	-	0.12	0.75	0.500
Hybrids							
RH-2	58518	59675	194.04	116.86	4.10	14.59	133.78
RML-32/ RML-17	58287	59259	189.06	111.36	3.95	14.91	133.94
F-test	NS	NS	NS	**	*	NS	NS
$LSD_{0.05}$	-		-	4.28	0.12	-	-
Plant density							
D1	65972	67638	202.64	116.04	3.96	14.70	135.25
D2	56180	57291	189.71	114.67	4.05	14.16	133.50
D3	53055	53472	182.29	111.63	4.07	15.38	132.83
F-test	***	**	**	**	**	**	**
$LSD_{0.05}$	557.2	733.90	18.55	4.28	0.12	0.48	0.500
CV,%	1.40	1.80	14.10	5.40	4.20	7.40	3.5
Grand mean	58402	59467	191.55	114.11	4.03	14.75	133.86

Ear height

Unlike the plant height, ear height was not affected by tillage methods revealing the more or less uniform placement of ears. However, the height was higher of 116.86cm in RH-2 compared to 111.36cm in RML-32/RML-17. Planting geometries of 65x25 cm apart had the highest plant height of 116.04ccm followed by 114.6 cm in 70×25cm and 111.63cm and in 75×25 cm (Table 56).

Cob diameter and length

Significant variation on cob diameter was observed due to tillage, genotype and planting geometries. Higher cob diameter of 4.16 was recorded in CT compared to 3.89 cm in NT. Rampur hybrid -2 had the higher diameter of cob compared to RMl-32/RMl-17. Similarly, the value was more in wider spaced plantings then closely spaced plantings. Similar results were found for cob length except the variation was not recorded due to different hybrids (Table 56).

Physiological maturity

Crop duration was affected significantly by tillage and planting geometry. Irrespective of genotype and planting geometry, crop from NT matured earlier at 131 days than CT at 136 days. Wider spaced crop matured earlier than the closed spaced and the crop planted at planting geometry of 75cm between rows (RR) and 25cm between plants (PP) matured earlier at 133 days followed by 133days in 70×25 cm and 65×25cm (Table 56).

Number of kernel rows/cob

Number of kernel rows/cob varied due to planting geometries only but not by genotype. Rampur Hybrid-2 had the higher (15.01) no of rows per cob as against the 13.12 in RML-32/RML-17 (Table 57).

Number of kernels/row

Difference due to tillage, genotypic and planting geometry was evident for the number of kernels rows-1. Significantly the highest number of kernels per row was recorded in NT (29.29) over CT (25.911), RML-32/RMl-17 (29.17) against RH-2 (26.02) and in 75×25vm spacing (28.46) (Table 57).

Thousand grain weight

Except planting geometry, no difference was observed due to tillage and genotype on the thousand grain weight of maize. Cropping geometry of 75x25cm produced the highest value of it (285.61g). Thus the higher thousand grain weight was observed in wider spaced planting than closely spaced (Table 57).

Grain yield

Grain yield of maize was significantly affected by tillage and cropping geometry. Genotypic differences among both the released hybrid (Rampur Hybrid-2) and pre-released hybrid (RML-32/RML-17) were not observed. The highest grain yield of 7012.18 kg/ha was harvested from NT as against 6037.59 kg/ha in CT. Similarly, planting at 65 × 25 cm spacing produced the highest grain yield of 7459.80 kg/ha over 75 × 25cm with 6033. 96 kg/ha (Table 57).

Stover yield

Stover yield of maize was also significantly affected by tillage and cropping geometry. Genotypic differences among both the released hybrids Rampur Hybrid-2 and RML-32/RML-17 were not observed. The highest Stover yield of 7863.95 kg/ha was harvested from NT as against 6879.58 kg/ha in CT. Similarly, planting at 65 × 25 cm spacing produced the highest grain yield of 8125.41 kg/ha over 70 × 25cm with 6888.30kg/ha (Table 57).

Harvest Index

Similar to grain yield, harvest index (HI) was also significantly varied due to tillage and cropping geometry. The highest HI value of 47 % was derived in NT as against 46% in CT. Similarly, planting at 65x25 cm spacing produced the highest HI of 47.85 % over 65 × 25cm with 46.07 %. However, the variation was not evident due to tested hybrids for stated trait (Table 57).

Economic analysis

Irrespective of tillage and genotype, the highest net return of NRs, 51032.22 was worked out in planting geometry of 60 × 25cm followed by 20184.74 in 75 × 25cm and 19045.18 in 70 × 25cm. Rampur hybrid-2 recorded the highest value of net return 32452.64 over RML-32/RML-17 with NRs. 27722.12 per hectare (Table 57). ANOVA revealed that the higher benefit cost ratio (BC) ratio of 1.36 was worked out in NT as compared to 1.18 in CT. Among the planting geometries, planting at 60 cm between rows and 25 cm between plants produced the highest 1.46 BC ratio as compared to 1.19 in 75 × 25cm and. 1.16 in 70x25cm (Table 57 and Fig 5).

Table 57. Effect of tillage, hybrids and planting densities on the crop performance of winter maize, Rampur, 2014

Treatment	No of kernel rows/ Cob	No of kernels /row	Thousand grain weight (g)	Grain yield (kg/ha)	Stover yield (kg/ha)	Harvest Index	BC ratio
Tillage methods							
CT	14.31	25.91	284.57	6037.59	6879.58	46.60	1.18
NT	14.00	29.29	283.73	7012.18	7863.95	47.07	1.36
F-test	NS	**	NS	**	*	*	*
$LSD_{0.05}$	-	1.71	-	281.60	576.8	0.29	0.11
Hybrids							
Rampur Hybrid-2	14.01	26.02	284.51	6630.12	7471.99	46.88	1.29
RML-32/ RML-17	12.12	29.17	283.78	6419.65	7271.53	46.79	1.25
F-test	**	**	NS	NS	NS	NS	NS
$LSD_{0.05}$	0.51	1.71	-	-	-	-	-
Plant density							
D1	14.08	27.79	283.16	7459.80	8125.41	47.85	1.46
D2	14.07	26.54	283.67	6080.91	6888.30	46.58	1.16
D3	14.05	28.46	285.61	6033.96	7101.58	46.07	1.18
F-test	NS	**	**	**	***	**	**
$LSD_{0.05}$	-	1.71	1.33	281.60	576.8	0.29	0.11
CV,%	5.30	9.00	7.2	12.90	11.40	0.90	12.5
Grand mean	14.07	27.60	284.15	6524.89	7371.76	46.83	1.27

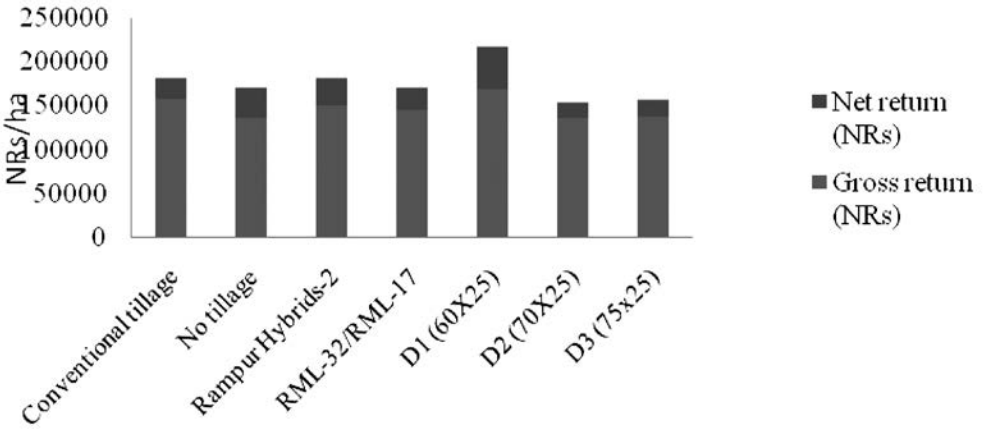


Fig 5: Summary of the economic analysis of various tillage methods, hybrids and plant densities, Rampur, 2014

Table 58. Effect of tillage, hybrids and planting densities on the soil pH and organic matter content, Rampur, 2014

Treatment	Soil pH	Soil organic matter (%)
Tillage methods		
Conventional tillage	5.46	2.43
No tillage	5.55	2.60
F-test	NS	*
$LSD_{0.05}$	0.58	0.03
Hybrids		
Rampur Hybrid-2	5.52	2.50
RML-32/RML-17	5.49	2.51
F-test	NS	NS
$LSD_{0.05}$	-	-
Planting geometry		
D1 (60×25)	5.46	2.46
D2 (70×25)	5.49	2.51
D3 (75×25)	5.55	2.52
F-test	NS	NS
$LSD_{0.05}$	-	-
CV%	1.5	3.7
Grand mean	5.50	2.49

Soil properties

The experiment started since 2012 winter season and completed the three seasons. Soil pH was found to be not affected by different tillage methods, genotype and planting densities. Unlike the soil pH, soil organic matter was found to be affected by tillage methods. The highest value of soil organic matter (2.46%) was recorded in NT as compared to 2.43% in CT (Table 58).

2.2.4 Effect of conservation and conventional tillage methods on various nitrogen levels in maize at Rampur, Chitwan, 2013-2014

In order to find out the appropriate doses of nitrogen for maize hybrids under conventional (CT) and conservation tillage (NT) methods, four levels of N (120, 150, 180 and 210 kg/ha) on top of the recommended doses of nitrogen (120 kg/ha) along with P (60 kg/ha) and K (40 kg/ha) an experiment had been carried out at Rampur. The promising pre-released NMRP hybrid RML-32/RML-17 was tested during the winter and spring season of 2013 and winter season of 2014. Soil properties, crop growth and yield contributing parameters along with economics were recorded during the experimentation.

Results

2.2.4.1 Winter season, 2013

Stalk lodging

Stalk lodging, by definition, is the breakage of the stalk below the ear. Severely lodged corn leads to increased harvest losses, increased harvest time and increased drying cost. The stalk lodging was not affected by tillage practice and application of different levels of nitrogen; however the intensity was higher in CT compared to NT (Table 59).

Number of cobs

Despite the uniform plant population in the experimental plots, the number of grain bearing cobs was significantly affected by tillage methods and the highest no of cobs were recorded in no tillage with residue retained (69358/ha) compared to the conventional tillage without residue retention (66580/ha) (Table 59).

Similarly, the variation in producing the number of cobs per hectare due to the various level of nitrogen was evident. The highest no of cobs (71354/ha) was found in plots with N applied at 210 kg/ha and the lowest no of cobs (65799/ha) were recorded in plots with 120 kg N/ha. The N applied @ 150 and 180 kg/ha was at par in producing the number of cobs per hectare (Table 59).

Shelling percent

Shelling percentage in conventional tillage was lower (76.200) than non-tillage practice (76.375). Thus the f-test in tillage practice was significant where as fertilizer application was non- significant (Table 59).

Table 59. Effect of tillage methods and N levels on the performance of maize, 2013

Treatment	No of cobs/ha	Stalk lodge plant/m^2	Shelling %	TGW (g)	Grain yield (kg/ ha)	Physiological maturity (days)	B:C Ratio
Tillage							
CT	66580	2.21	76.200	267.08	7261.	150.50	1.823
NT	69358	0.28	76.375	261.50	7355	146.83	2.341
F-test	***	NS	***	***	***	***	***
$LSD_{0.05}$	1114.9	-	0.4281	1.358	326.8	0.453	0.1189
N-levels							
120: 60:40 kg NPK/ha	65799	1.74	75.050	260.17	6632.	149.83	1.977
150: 60:40 kg NPK/ha	67014	1.72	75.817	263.83	6991.	149.33	2.023
180:60:40 kg NPK/ha	67708	1.01	76.850	266.00	7459.	148.17	2.102
210:60:40 kg NPK/ha	71354	0.50	77.433	267.17	8150	147.33	2.225
Grand mean	67969	1.24	76.288	264.29	7308	148.67	2.082
F-test	***	NS	NS	***	***	***	NS
$LSD_{0.05}$	1576.7	-	-	1.920	462.2	0.641	-
CV%	1.9	109.2	0.6	0.6	5.1	0.3	6.6

Thousand grain weight

Thousand grain weights in conventional tillage were more (267.08g) than the thousand grain weight of non-tillage method (261.50g). It was also significantly affected by different doses of nitrogen and the highest of 267.17g in 210 kg N/ ha and the lowest of 260.17g in 120 kg N/ha (Table 59).

Grain yield

Grain yield of maize varied significantly due to different tillage methods and N levels. Grain yield in no tillage (7355 kg/ha) is higher than conservation tillage (6261 kg). The highest grain yield of 8150 kg/ha was found in 210kg N/ha applied plot and the lowest of 6632 kg/ha were recorded in 120 kg N/ha applied plot (Table 59).

Physiological maturity

Physiological maturity period was also found to be affected by various tillage methods and N levels. The crop matured earlier in no tillage with 146.83 days than conventional tillage with 150.50 days. Interestingly, the crop matured 5.398 days earlier in the plots where 210 kg N/ha was applied compared to the 120 kg N/ha. However, the N doses of 120 kg/ha and 150 kg/ha were at par for days to crop maturity (Table 59).

Benefit-cost ratio

Benefit cost ratio was found higher in no tillage (2.3) compared to the conventional tillage (1.8). It was not affected by various N levels. The BC ratio of 2.2 was found in 210 kg N/ha and low (1.9) in 120 kg N/ ha.

Conclusion:

The conventional and no tillage affected the yield of the maize. The different level of nitrogen also affects the yield of maize. Similarly, the effect of tillage was obvious for thousand grain weight and yield of maize. Benefit cost ratio was found higher in no tillage (2.3) compared to the conventional tillage (1.8).

2.2.4.2 Spring, 2013

Stalk lodging

Severity of stalk lodging was higher in conventional tillage (3.58/m^2) compared to the no tillage condition (0.92/m^2). The intensity was higher (2.50) in application of 150 kg N/ha and lower (2.00) in 120 kg N/ha (Table 60).

No of cobs

The tillage methods did not affect number of cobs per at maturity, however conventional tillage had lower (61545) than no tillage (62066). But the various N levels affected the number of cobs /ha. The highest no of cobs (64410/ha) was found in 210kg N/ha and the lowest no of cobs (59549/ha) was recorded in 120 kg N/ha. However, 180 and 210 kg N/ha were ad part in producing the number of cobs/ha (Table 60).

Shelling percent

Shelling percentage was not significantly affected by various tillage methods and N levels (Table 60).

Thousand grain weight

Like in shelling percentage, thousand grain weight of maize was not affected by both tillage methods and N levels (Table 2). However, the higher grain weight (265.50 g) was recorded in 210 kg N compared to 258.50g in 120 kg N/ ha (Table 60).

Table 60. Effect of tillage and N levels on various traits of maize and BC ratio, 2013 spring

Treatment	Cobs/ha	Stalk lodge plants	Shelling %	TGM (g)	Grain yield (kg/ha)	Physiological maturity (days)	B/C Ratio
Tillage							
CT	61545	3.58	73.233	259.17	4685.0	120.42	1.1367
NT	62066	0.92	73.267	264.17	5076.0	117.58	1.2917
F test	NS	NS	NS	NS	***	NS	***
LSD	-	-	-	-	132.3	-	0.03607
N levels							
120: 60:40 kg NPK/ha	59549	2.00	72.183	258.50	4565	119.67	1.1850
150: 60:40 kg NPK/ha	60590	2.50	72.867	260.83	4693	119.83	1.1833
180: 60:40 kg NPK/ha	62674	2.17	73.733	261.83	4969	118.33	1.2200
210: 60:40 kg NPK/ha	64410	2.33	74.217	265.50	5296	118.17	1.2683
Grand mean	61806	2.25	73.250	261.67	4881	119.00	1.2142
F test	***	NS	NS	NS	***	NS	NS
LSD	1680.1	-	-	-	187.1	-	-
CV,%	2.2	50.3	0.5	1.5	3.1	0.5	3.4

Grain yield

The grain yield varied significantly due to various tillage methods and N levels. The grain yield of 5076 kg/ha) in no tillage was higher than conventional tillage (4685kg/ha). The highest grain yield of 5296kg/ha was found in 210kg N/ha over the lowest yield of 4565kg/ha in 120 kg N/ha (Table 60).

Physiological maturity

Days taken to attain physiological maturity were not influenced significantly by various tillage methods and N levels. However, the crop under no tillage plots matured 3 days earlier than conventional tillage plot (Table 60).

Benefit cost ratio

BC ratio was found to be higher in no tillage (1.29) compared to the conventional tillage methods. Similarly, BC ratio was found the highest of 1.26 in 210 kg N per ha and the lowest of 1.18 in 150 kg N per ha (Table 60).

Conclusion

The conservation and no tillage affect the yield of the maize. The different levels of nitrogen also affect the yield of maize. Similarly, the effect of tillage was obvious for thousand grain weight and yield of maize. BC ratio was also higher in no tillage (1.2917) compare to the conventional tillage. The BC ratio of 1.26 was found in 210 kg N per ha and 1.18 in 150 kg N/ha.

2.2.4.3 Winter 2014

Stalk lodging

Severity of stalk lodging was not affected by various tillage methods and N levels (Table 61).

Number of cobs

The total number of cobs per hectare was not affected by different tillage methods and nitrogen levels (Table 61).

Shelling percent

The shelling percentage did not vary due to various levels of nitrogen and tillage methods (Table 61).

Thousand grain weight

Thousand grain weights varied significantly by various tillage methods and the highest of 270.50g it was found in no tillage compared the lowest of 264.50 g was recorded in conventional tillage. However, the trait was not influenced by the application of various levels of N (Table 61).

Grain yield

ANOVA revealed that the various tillage methods and nitrogen levels affected significantly the grain yield of maize in 2014 winter season. Grain yield in no tilled plot had 7928 kg/ha compared to the conventionally tilled plot with 7546 kg/ha. Similarly, the highest grain yield of 8385 kg/ha was found due to 210kg N/ha and the lowest of 7132 kg/ha due to 120 kg N/ha. N at 180 and 210 kg/ha were at par in producing the grain yield of maize during 2014 winter season (Table 61).

Physiological maturity

Days taken to attain physiological maturity were not influenced significantly by various tillage methods and N levels. However, the crop under no tillage plots matured 3 days earlier than conventional tillage plot (Table 61).

Benefit cost ratio

Benefit cost ratio was found to be higher in no tillage (1.95) compared to the conventional tillage methods (1.67). Similarly, BC ratio was found the highest of 1.89 in 210 kg N per ha and the lowest of 1.74 in 120 kg N/ha (Table 61).

Table 61. Effect of tillage and N levels on various traits of maize and BC ratio, 2014 winter

Treatment	Cobs/ha	Stalk lodge plants	Shelling %	TGM (g)	Grain yield (kg/ha)	Physiological maturity (days)	B/C Ratio
Tillage							
CT	71962	868.0	77.13	264.50	7546.0	151.25	1.678
NT	72309	174.0	77.01	270.50	7928.0	147.83	1.948
F test	NS	NS	NS	***	***	NS	***
LSD	-	-	-	1.664	191.2	-	0.0760
N levels							
120: 60:40 kg NPK/ha	68576	521.0	76.25	264.50	7132.0	150.17	1.740
150: 60:40 kg NPK/ha	69271	868.0	76.86	266.83	7387.0	150.00	1.758
180: 60:40 kg NPK/ha	73958.	347.0	77.3877.80	269.00	8043.0	149.33	1.860
210: 60:40 kg NPK/ha	76736	347.0	77.80	269.67	838.05	148.67	1.893
Grand mean	72135	521.0	77.07	267.50	7737.0	149.54	1.813
F test	NS	NS	NS	NS	***	NS	*
LSD	-	-	-	-	270.3	-	0.104
CV,%	4.5	96.3	0.5	0.7	2.8	0.6	4.8

Soil properties

Soil pH and organic matter content at the time of experimental establishment were 5.75 and 2.73 respectively. The status of pH did not vary due to tillage methods and nitrogen levels after the harvesting of third crop during the experimental period. However, the soil organic matter content varied because of tillage methods and the highest value of 2.81% was found in NT compared to 2.72% in CT (Table 62).

Table 62. Effect of tillage and different levels of nitrogen on soil pH and organic matter content (%) after the harvest of 2014 winter maize

Treatment	Soil pH	Soil organic matter (%)
Tillage		
CT	5.78	2.72
NT	5.77	2.82
F-test	NS	**
$LSD_{0.05}$	-	0.04
Nitrogen levels		
120: 60:40 kg NPK/ha	5.77	2.78
150: 60:40 kg NPK/ha	5.77	2.72
180: 60:40 kg NPK/ha	5.79	2.78
210: 60:40 kg NPK/ha	5.76	2.78
F-test	NS	NS
$LSD_{0.05}$	-	-
CV,%	0.5	1.7
Grand mean	5.77	2.76

Conclusion

The conventional and no tillage affected the grain yield of maize. The different level of nitrogen also affected the grain yield of maize. Similarly, the effect of tillage was obvious for test weight of maize. BC ratio was higher in no tillage (1.94) compared to the conventional tillage (1.67). The BC ratio of 1.89 was found in 210 kg N per ha and the lowest of 1.74 in 120 kg N per ha.

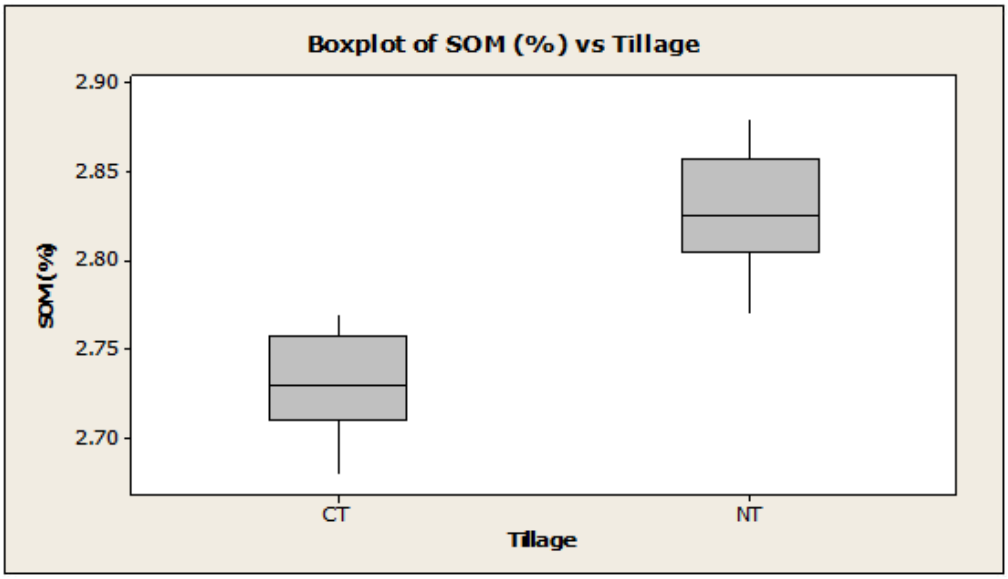


Fig 6. Soil organic matter content (%) as affected by tillage methods, 2014 winter

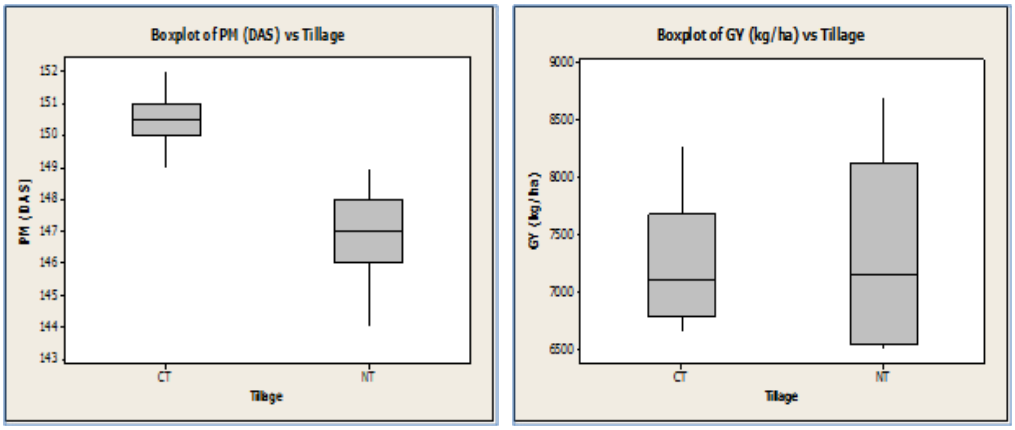


Fig 7. Maturity days and grain yield of maize as affected by tillage methods, 2014 winter

2.2.5 Weed management in maize, Rampur, 2014

With the aim of identifying the appropriate techniques of managing weeds in upland maize, an experiment comprising of tillage with two levels (with and without tillage) and various weed management methods (weedy check, weed free, farmer practice (2 hand pullings at 30 and 45 Days after seeding (DAS)), Atrazine @ 1.5 kg ai/ha –pre emergence, Atrazine @ 0.75 kg ai/ha + pendimethalin (30% EC) @0.5 kg ai/ha – pre emergence (tank mixture), Atrazine @ 1.5 kg ai/ha – pre emergence + 2, 4 -D Na salt 80 %WP @ 1 kg ai/

ha - post emergence at 30 DAS, Atrazine @ 0.75 kg ai/ha + glyphosate (41% SL) @ 0.8 kg ai/ha – pre emergence (tank mixture) and Atrazine @ 1.5 kg ai/ha – pre emergence + hand pulling at 30 DAS were tested during summer season of 2014. Rest of the crop management practices were deployed as per the standard package of practices for maize.

Cob length

Cob length of maize significantly varied due to both tillage and weed management methods. As compared to the conventional tillage (14.10cm) no tillage produced the longest cobs (14.49 cm). Similarly, the longest cob length (15.73cm) was recorded in weed free condition and the least of it was recorded in weedy check (13.13cm) (Table 63).

Cob diameter

Unlike cob length, diameter was not affected by tillage methods, but was by weed management methods. Weed free produced the highest cob diameter of 3.95cm and was at par with atrazine + glyphosate (PE) and atrazine (PE) along with manual weeding. On the contrary, the lowest diameter of cob was found in weedy check (3.70 cm). The rest of the treatments were at par with weedy check in producing the diameter of the cob (Table 63).

Number of kernel rows per ear

Number of kernel rows per ear were not affected by both tillage and weed management methods (Table 63).

Number of kernels per row

Unlike the rows, the number of kernels per row was affected by tillage and weed management methods. No tillage had 19.33 and conventional tillage had 18.13 numbers of kernels per row. Weed free plot (20.72) along with all the combination of herbicides produced the highest number of kernels per row compared to weedy check (16.38) and atrazine only (16.97) (Table 63).

Thousand grain weight

Thousand grain weights did not vary due to tillage methods, but varied due to various weed management methods. The value was the highest in weed free plot 308.33g compared 276.67g in weedy check plot. Rest of the treatments was at par with weed free for this trait (Table 63).

Grain yield

Variation in grain yield was obvious due to tillage methods. The highest grain yield was recorded in no tillage with 4222.32 kg/ha and the least in conventional tillage with (3724.89 kg/ha). Similarly, the highest grain yield was found in weed free plot with 4884.50 kg/ha and was also similar to atrazine+ glyphosate (PE) with 4526.67 kg/ha and atrazine (PE) + one manual weeding with 4422.22 kg/ha. Obviously the weedy check plot yielded the least (2055.42 kg/ha) (Table 63).

Table 63. Effects of various tillage and weed control methods on grain yield and its contributing traits of maize, Rampur, 2014.

Treatments	Cob length (cm)	Cob diameter (cm)	No of kernel rows/ cob	No of kernels/row	Thousand grain wt (g)	Grain yield (kg/ ha)
Tillage methods						
Conventional tillage	14.10	3.70	11.58	18.13	294.70	3724.89
No tillage	14.49	3.76	11.71	19.33	299.40	4222.32
F-test	*	NS	NS	*	NS	**
$LSD_{0.05}$	0.37	-	-	1.05	-	245.00
Weed management methods						
Weedy check	13.13	3.70	11.00	16.38	276.67	2055.42
Weed free	15.73	3.95	11.90	20.72	308.33	4884.50
Farmer's practice	13.92	3.71	11.57	18.74	293.00	3745.56
Atrazine (PE)	14.24	3.28	11.83	16.97	293.33	3860.00
Atrazine + Pendimethalin (PE)	14.40	3.74	11.47	19.60	310.50	3980.00
Atrazine (PE)+2,4-D (Post)	14.29	3.76	11.63	18.84	295.83	4314.45
Atrazine+ Glyphosate (PE)	14.25	3.83	11.90	19.92	296.67	4526.67
Atrazine (PE)+ Manual weeding	14.38	3.86	11.83	18.67	298.33	4422.22
F-test	**	**	NS	*	*	**
$LSD_{0.05}$	0.74	0.15	-	2.1	17.31	490.00
CV%	4.4	3.5	5.3	9.5	4.9	10.50
Grand mean	14.29	3.73	11.64	18.73	296.6	3974.00

Weed biomass

Weed biomass was not affected by tillage methods except at 30 DAS, where no tillage had the lowest weed biomass compared to CT. But the effect was significant due to various weed management methods. Weedy check plot produced the highest biomass weight of weed 6.11, 43.41, 64.59 and 60.63g/m^2 at 30, 60, 90 days after seeding and at harvest (Table 64).

Table 64. Effects of various tillage and weed control methods on weed biomass (g/m^2) at different time series, Rampur, 2014.

Treatment	Weed bio-30DAS	SQRT-30DAS	Weed bio-60DAS	SQRT -60DAS	Weed Bio-90 DAS	SQRT-90DAS	Weed bio-harvest	SQRT-harvest
Tillage methods								
CT	4.63	2.21	18.44	3.95	35.39	5.71	41.64	6.18
NT	1.79	1.60	13.91	3.50	35.52	5.67	38.80	5.93
F test		**		NS		NS		NS
LSD		0.305		-		-		-
Weed management methods								
Atra+ Manual	2.54	1.78	12.16	3.54	37.25	6.17	46.02	6.84
Atrazine (PE)	3.31	1.95	19.93	4.40	42.21	6.54	48.30	7.00
Atrazine (PE)+ Pendimethalin	2.34	1.70	16.08	3.95	41.23	6.47	46.87	6.90
Atrazine Pre+2,4-D Post	3.83	1.99	10.15	2.97	28.72	5.41	24.88	5.03
Atrazine+ Glyphosate	1.67	1.61	17.92	4.13	35.65	6.02	44.92	6.74
Farmer's practice	5.90	2.60	9.77	3.23	34.02	5.90	50.15	7.14
Weed free	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Weedy check	6.11	2.59	43.41	6.58	64.59	8.03	60.63	7.82
F test		**		**		**		**
LSD		0.611		1.342		0.804		0.712
CV,%		27.3		30.6		12		10.0
Grand mean		1.902		3.72		5.693		6.059

Weed biomass followed the order as atrazine, atrazine+ pendimethalin, farmers practice, atrazine+ glyphosate , atrazine and one hand weeding, atrazine + 2,4D (3.83,10.15, 28.72 and 24.88 g/m^2 at 30, 60, 90 DAS and at harvest respectively) and weed free plot across the time series (Table 64).

2.2.6 Intercropping of Rajma with winter maize at Rampur

An experiment on maize and rajma intercropping was planted at two dates of 15 days interval) in NMRP, Rampur, during the winter season, 2014/2015. Five released maize genotype namely Rampur hybrid-2, Manakamana-3, Rampur composite, Poshilo Makai-1 and Arun-2 were tested in the experiment.

Similarly, PDR-14 was the variety of Rajma tested in the experiment. Two maize row spacing of 75 cm x 25 cms were employed to get 53000 plants/ha and 100 cm x 25cm for 40000 plants/ha. Between the two rows of maize spaced at 75 cm, rajma was planted at 30, 35 and 37.5 cm and 40, 45 and 50 cm at 100 cm between rows.

Results

2.2.6.1 First planting on 2071-7-16 (2 Nov, 2014)

Maize yield

Rampur composite at plant density of 53333/ha with 2 rows of rajma at 35 cm spacing produced the highest grain yield of 3555 kg/ha. Similarly Poshilo makai-1 produced the 3062 kg/ha of grain yield with 2 rows of rajma at 37.5 Cm spacing and Rampur composite with 3068 kg/ha having 30 cm spacing of rajma (table-65).

Under the maize spacing of 100cm × 25 cm (40000/ha), Rampur composite produced the highest grain yield of 4407 kg /ha with 50 cm row spacing of Rajma. Similarly Poshilo Makai-1 yielded 3438 kg/ha with 50 cm row spacing of Rajma and Rampur Hybrid-2 produced the grain yield of 3407 kg/ha with 50 cm of Rajma respectively (Table-65).

Table 65. Performance of maize genotype under various intercropping with Rajma, Rampur

Treatment	Grain yield (kg/ha)				
	Rampur hybrid-2	Manakamna -3	Rampur composite	Poshilo makai-1	Arun-2
M 75×25-R-30 cm	2175	1747	3061(iii)	2309	2107
M 75×25 -R 35cm	2320	1873	3555(i)	2259	2266
M75×25 -R-37.5	2730	2153	1394	3062(ii)	2341
M100×25 -R 40 cm	3201	2944	3415	3114	2707
M100×25 -R 45 cm	3407(iii)	2926	4259	3150	2859
M100×25 -R 50 cm	3185	2370	4407(i)	3438(ii)	3182
M100×25 -Sole	3393	2963	4169	2963	3148
M 75×25 Sole	3852	3338	4395	3227	3481
F-test	**	NS	*	NS	*
$LSD_{0.05}$	648.3	1137	1152.7	1051.4	670.4
CV %	12.2	25.6	17.1	20.4	13.8
Grand mean	3033	2539	3858	2940	2770

Note: M-maize, R-Rajma

Rajma yield

Under the maize plant population of 40000, the highest grain yield of Rajma was obtained 2837 kg/ha in 50 cm apart from maize row with Rampur composite followed by 2707 kg /ha Arun-2 with 50 cm and 2663 kg /ha with 50 cm in Manakamana-3 (Table 66).

Table 66. Performance of Rajma under various intercropping with maize, Rampur

Treatment	Grain yield (kg/ha)				
	R.Hybrid	Mana-3	R.Compo	Posilo	Arun-2
M 75×25-R-30 cm	1727	1692	1897	1775	1588
M75×25 -R 35cm	1815	1473	1966	1915	2090(iii)
M75×25 -R-37.5	2081	1927	2205(ii)	2075	2259(i)
M100×25 -R 40 cm	2430	2137	2600	2359	2347
M100×25 -R 45 cm	2258	2474	2483	2663	2415
M100×25 -R 50 cm	2579	2663(iii)	2471	2837(i)	2707(ii)
R 50×15 -Sole	3201	2926	2259	3114	2707
R 50×15 Sole	3407	2944	2815	2837	2859
F-test	**	*	**	**	**
$LSD_{0.05}$	287.3	887.9	805.9	545.3	524.9
CV %	6.7	22.6	17	12.5	13.4
Mean	2437	2242	2710	2486	2241

Higher LER (1.994) was obtained in the intercropping of Poshilo makai-1 with rajma (with plant population of 40000) (Table 67).

Table 67. Land equivalent ratio of maize genotype unver various intercropping with Rajma, 2014

S. N.	Treatment	LER				
		Rampur hybrid-2 + Rajma	Mankamana -3 +Rajma	Rampur Compsite +Rajma	Poshilo makai-1 +Rajma	Arun-2 +Rajma
1	M 75×25 -R-30 cm	1.621	1.536	1.379	1.551	1.528
2	M75×25 -R 35cm	1.683	1.687	1.473	1.502	1.925
3	M75×25 -R-37.5	1.693	1.632	1.552	1.587	1.819
4	M100×25 -R 40 cm	1.911	1.79	1.676	1.79	1.963
5	M100×25 -R 45 cm	1.786	1.7	1.962	1.775	1.929
6	M100×25 -R 50 cm	1.574	1.99	1.977	1.994	1.83
7	M100×25 -Sole	1	1	1	1	1
8	M 75×25 Sole	1	1	1	1	1

2.2.6.2 Second planting on 2071-8-1 (17 Nov, 2014)

Grain yield of maize and rajma (maize population 53000/ha)

The highest grain yield of maize Rampur Composite 3455 kg/ha in 35 cm with Rajma followed by 3062 kg/ha within 37.5 cm Poshilo makai and Rampur Composite 3058 kg /ha 30 cm of rajma spacing (Table 68).

Grain yield of maize and rajma (maize population 40000/ha)

The highest grain yield of maize Rampur composite 3515 kg/ha in 50 cm with Rajma followed by 3450 kg/ha Poshilo makai-1 within 50 cm Rajma and 3407 kg /ha Rampur hybrid-2 at 45 cm spacing of rajma (Table 68).

Table 68. Performance of maize genotype under various intercropping with rajma, Rampur

Treatment	Grain yield of maize (kg/ha)				
	Rampur hybrid-2 + Rajma	Mankamana -3 +Rajma	Rampur Compsite +Rajma	Poshilo makai-1 +Rajma	Arun-2 +Rajma
M 75×25 +R-30cm	2175	1747	3058	2309	2107
M75×25 +R 35cm	2320	1873	3455	2259	2266
M75×25 +R-37.5cm	2730	2153	1394	3062	2341
M100×25 *R 40 cm	3201	2944	3415	3114	2707
M100×25 +R 45 cm	3407	2926	4259	3150	2859
M100×25 +R 50 cm	3185	2370	3515	3450	3182
M100×25cm (Sole)	3393	2963	4169	2963	3148
M 75×25cm (Sole)	3852	3338	4395	3227	3481
F-test	**	*	*	NS	*
$LSD_{0.05}$	648.3	1137	1152.7	1051.4	670.4
CV %	12.2	25.6	17.1	20.4	13.8
Grand mean	3033	2539	3858	2940	2770

Note: M-Maize, R-Rajma

2.2.6.3 Second planting of Rajma on 2071-8-1 (17 Nov, 2014)

Table 69. Late planting of the rajma and their yield under different variety of the maize

Treatment	Rajma yield (kg/ha)				
	Manakamana -3+ Rajma	Rampur composite +Rajma	Poshilo makai-1+Rajma	Arun -2+ Rajma	Rampur hybrid-2+ Rajma
M 75×25 +R-30cm	1593	1503	1361	1515	1127
M75×25 +R 35cm	1717	1671	1605	1684	1830(ii)
M75×25 +R-37.5cm	1789(iii)	1658	1869(i)	1667	1693
M100×25 ×R 40 cm	1800	2037	1753	1719	1927
M100×25 +R 45 cm	1889	1930	2070	1933	1963
M100×25 +R 50 cm	2273(iii)	2050	2290(ii)	2116	2368(i)
M100×25cm (Sole)	1701	1768	2010	1842	1708
F test	**	**	*	*	*
$LSD_{0.05}$	255.1	319.5	370.7	291.6	225
CV %	7.7	9.6	11.3	9.2	22.2
Mean	1852	1880	1851	1782	1830

Note: M-Maize, R-Rajma

Rajma yield

Rajma under the same population density of maize, produced the highest grain yield of 2368 kg/ha in 50 cm row spacing with Arun-2 followed by 2290 kg/ha in 50 cm row spacing of Rajma with Rampur composite and 2273 kg/ha in 35 cm row spacing of Rajma with Arun-2 (Table 70).

The highest grain yield of Rajma (2837 kg/ha) produced at 50 cm row spacing of Rajma with Poshilo makai-1 followed by 2707 kg/ha in 50 cm of spacing of Rajma with Arun-2 and 2663 kg/ha of grain yield was obtained at 50 cm spacing of Manakamana-3 (Table 70).

Table 70. Grain yield of different maize genotype intercropping with Rajma under various spacings

Treatment/Space	Grain yield (kg/ha)				
	Rampur hybrid-2 + Rajma	Mankamana -3 +Rajma	Rampur Compsite +Rajma	Poshilo makai-1 +Rajma	Arun-2 +Rajma
M 75×25 -R-30 cm	1727	1692	1897	1775	1588
M75×25 -R 35cm	1815	1473	1966	1915	2090(iii)
M75×25 -R-37.5	2081	1927	2205(II)	2075	2259(i)
R 50×15 Sole	3407	2944	2815	2837	2859
M100×25 -R 40 cm	2430	2137	2600	2359	2347
M100×25 -R 45 cm	2258	2474	2483	2663	2415
M100×25 -R 50 cm	2579	2663(iii)	2471	2837(i)	2707(ii)
R 50×15 -Sole	3201	2926	2259	3114	2707
LSD	287.3	887.9	805.9	545.3	524.9
CV,%	6.7	22.6	17	12.5	13.4
Grand mean	2437	2242	2710	2486	2241

Table 71. Land Equivalent Ratio (LER) of different maize varieties with Rajma in intercropping trial at Rampur, Chitwan

Treatment/Space	Land equivalent ratio				
	Rampur hybrid / Rajma	Mankamana-3 /Rajma	Rampur Compsite/ Rajma	Poshilo makai-1/ Rajma	Arun-2 / Rajma
M 75×25 -R-30 cm	1.072	1.098	1.732	1.341	1.161
M75×25 -R 35cm	1.135	1.061	1.507	1.375	1.382
M75×25 -R-37.5	1.32	1.3	1.1	1.68	1.463
M100×25 -R 40 cm	1.703	1.724	1.839	1.809	1.681
M 100 ×25 -R 45 cm	1.71	1.833	1.904	1.918	1.753
M 100×25 -R 50 cm	1.744	1.71	1.935	1.767	1.958
M 100 × 25 -Sole	1	1	1	1	1
M 75 × 25 Sole	1	1	1	1	1
R 50×15 Sole	1	1	1	1	1

Late planting of the maize plant population maximum LER 1.732 on the maize Rampur composite space 30 cm and 1.680 Poshilo makai-1 space 50 cm. Similarly 40000 maize plant population maximum LER Arun-2 gave 1.958 space 50 cm and1.935 maize Rampur Composite space 50 cm (Table 71).

Conclusion

Early planting of maize during the first week of November, Rampur composite produced the highest grain yield of maize (4407 kg/ha) with Rajma (2471 kg / ha) at the spacing of 100 × 50 cm.

Late planting of maize during the third week of November, Rampur composite produced the highest grain yield of (3515 kg/ha) with 2290 kg /ha of Rajma at the spacing of 100 × 50cm, however the yield of both the crops was reduced as compared to the early planting.

2.2.7 Performance of open pollinated varieties and hybrid maize throughout the year at Rampur, Chitwan, Nepal during 2071

Materials and methods

The experiment was conducted at Rampur, Chitwan, Nepal during 2013/14 and 2014/15. Maize was sown on loamy sand acidic soil (pH 5.0), medium in total nitrogen (0.130%), high in soil available phosphorous (279 kg/ha), medium soil available potassium (215 kg/ha) and high in organic matter content (2.70%) (NMRP, 2012). Four genotype namely S99TLYQ-B, RML-4/RML-17, RML-32/RML-17 and ACROSS-9944/ACROSS-9942 were sown in every week from First week of Baisakh (April) to last week of Chaitra (March). The design was randomized complete block design with four replication. In each month, the planting was replicated 4 times at seven days intervals. Spacings of 75 cm between row to row and 25 cm plant to plant was maintained. Two rows of 5 meter length during 2071 in which, whole plot was used to assess final harvesters. FYM @10 t/ha and 120:60:40 kg NPK kg/ha was applied for each experiment. Half dose of nitrogen and full dose of phosphorous and potash was applied as basal at the time of land preparation and remaining half of nitrogen was divided into two; first applied at 20-24 and second at 40-45 days after sowing. Weeding and irrigation was done as per recommendations. Data of plant height, ear height, days to maturity and grain yield was recorded and analyzed using Gen stat statistical software.

Results

Determination of sowing dates for maize varieties is very crucial for better crop yield. Grain yield of maize influenced by varieties and date of sowing is shown in Table 72. Varieties also showed highly significant effect on yield. Winter maize had higher production potential than the rainy season maize. Pests like insects, diseases, weeds were not the problematic during winter season but sometimes parrot was a problem during maturity period. Crop received longer sunshine duration, higher rate of photosynthesis and assimilates utilization occurs during winter season.

Grain yield

Analyzed result of one year showed that the effects of date of sowing on ear height, grain yield and maturity days were highly significant and plant height was non significant, likewise the effect of varieties also found highly significant for grain yield and ear height and non significant for maturity days. While considering the mean yield of the four varieties over month, the highest grain yield was obtained in Bhadra planting (5280 kg/ha) followed by Falgun (5266 kg/ha) and Aasad planting (4475 kg/ha) respectively. The mean days to maturity was also found the longest (158 days) in Bhadra planting whereas, the shortest in Chaitra planting (82 Days) (Table 72). In 2071, the interaction effect of date of sowing and varieties on grain yield revealed that the hybrid variety RML-4/ RML-17 produced the highest grain yield (6894 kg/ha) in Aasad and 6649kg/ ha in Falgun planting followed by RML-32/RML-17 (6520 kg/ha) in Falgun and 6517 kg/ha in Bhadra planting. ACROSS-9944/9942 produced the highest grain yield of 5723 kg/ha in Bhadra and S99TLYQ-B (4198 kg/ha) in Falgun planting. Comparatively lowest yields were produced by all the genotype during Mangsir and Paush planting (Table 73).

Table 72. Effect of monthly planting of various maize genotpes on mean plant height, ear height, grain Yield (kg/ha) and maturity days at NMRP, Rampur, during (2014/2015).

Treatments	Plant height (cm)	Ear height (cm)	Grain Yield (kg/ha)	Maturity Days
Month of sowing				
Baisakh (APR/MAY)	190.0	100.3	3918.	88.38
Jesth (MAY/JUNE)	174.4	93.8	4289.	85.75
Aasad (JUNE/JULY)	181.4	92.5	4475.	109.88
Shrawan (JULY/AUG)	190.9	100.9	4249.	150.19
Bhadra (AUG/SEPT)	181.6	86.8	5280.	158.69
Aaswin (SEPT/OCT)	121.4	50.9	3491.	154.44
Kartik (OCT/NOV)	134.9	64.4	3878.	143.50
Mangsir (NOV/DEC)	150.6	77.6	2478	126.13
Paush (DEC/JAN)	142.8	69.7	2970.	106.88
Magh (JAN/FEB)	158.1	75.6	3238.	99.19
Falgun (FEB/MAR)	185.3	96.3	5266.	86.25
Chaitra (MAR/APR)	176.9	91.9	3912.	81.56
F-test(>0.05)	NS	**	**	**
Variety				
S99TLYQ-B	162.9	78.6	2802.	115.85
RML-4/RML-17	167.9	90.2	4884.	115.04
RML-32/RML-17	166.9	82.0	4958.	115.90
Accross9944/9942	165.1	82.8	3170.	116.81
F-test (≤0.05)	NS	*	**	NS
Grand mean	165.7	83.4	3954.	115.90
F-test	NS	Ns	Ns	Ns
CV %	15.0	21.7	31.4	6.1
$LSD_{0.05}$	34.65	25.24	2121.1	9.819

Days to maturity

The interaction effects of date of sowing and varieties days to maturity were not significantly differences, where, grand mean days to maturity of varieties was 115 days. The longest maturity days was found ranging from 157 to 160 days during Bhadra planting and shortest days to maturity was found ranging from.80 to 83 days of all the varieties in Chaitra planting of 2071 BS(Table 72).

Table 73. Interaction effects of date of sowing and variety on grain yield (kg/ha) at NMRP, Rampur, during (2014/15)

Sowing Month	Genotype			
	S99TLYQ-B	RML-4/RML-17	RML-32/RML-17	Accross9944/9942
Baisakh	3053.	4915.	4946.	2757
Jesth	2153.	5925.	6485.	2590.
Aasad	2907	6894	5784	2314
Shrawan	3145.	5541.	4934.	3375.
Bhadra	2963.	5916.	6517.	5723.
Aaswin	3729.	3219.	3483.	3534.
Kartik	2084.	3554.	5690.	4186.
Mangsir	1706.	2775.	3177.	2252.
Paush	2108.	3722.	3653.	2396.
Magh	2584.	4217.	3897.	2252.
Falgun	4198.	6649.	6520.	3698.
Chaitra	2998.	5278.	4408.	2966.
Grand mean	3954.			
F-test	Ns			
CV, %	38.4			
$LSD_{0.05}$	2121.1			

Table 74. Interaction effects of date of sowing and variety on maturity days at NMRP, Rampur, during (2014/15)

Sowing Month	Genotype			
	S99 TLYQ-B	RML-4/RML-17	RML-32/RML-17	Across 9944/9942
Baisakh	88.50	87.75	87.75	89.50
Jesth	85.25	86.75	85.25	85.75
Aasad	108.00	110.25	109.50	111.75
Shrawan	149.75	148.50	150.50	152.00
Bhadra	157.50	158.00	158.50	160.75
Aaswin	157.75	152.50	152.50	155.00
Kartik	145.00	136.50	149.00	143.50
Mangsir	126.00	126.00	126.00	126.50
Paush	105.25	106.75	107.25	108.25
Magh	97.75	99.75	99.50	99.75
Falgun	88.25	86.25	84.25	86.25
Chaitra	81.25	81.50	80.75	82.75
Grand mean	115.90			
F-test	Ns			
CV, %	6.1			
$LSD_{0.05}$	9.819			

Table 75. Interaction effects of date of sowing and variety on Plant height in cm at NMRP, Rampur, during (2014/15)

Sowing month	Genotype				Genotype mean
	S99 TLYQ-B	RML-4/RML-17	RML-32/RML-17	Across 9944/9942	
Baisakh	178.8	193.8	181.3	206.3	190.0
Jesth	186.3	171.3	167.5	172.5	174.4
Aasad	167.5	196.8	180.0	181.3	181.4
Shrawan	190.3	184.5	192.8	196.3	190.9
Bhadra	193.8	171.3	186.3	175.0	181.6
Aaswin	127.5	119.2	123.7	115.0	121.4
Kartik	127.5	138.8	130.8	142.5	134.9
Mangsir	127.5	151.3	160.0	163.8	150.6
Paush	137.5	153.8	145.0	135.0	142.8
Magh	158.8	165.0	157.5	151.3	158.1
Falgun	182.5	191.3	183.8	183.8	185.3
Chaitra	177.5	177.5	193.8	158.8	176.9
Mean of Month	162.9	167.9	166.9	165.1	
Grand mean	165.7				
F-test	Ns				
CV,-%	15.0				
$LSD_{0.05}$	34.65				

Table 76. Interaction effects of date of sowing and variety on ear height in cm at NMRP, Rampur, during (2014/15)

Sowing Month	Genotype				Genotype mean
	S99 TLYQ-B	RML-4/RML-17	RML-32/RML-17	Across 9944/9942	
Baisakh	83.7	108.7	95.0	113.7	100.3
Jesth	102.5	92.5	92.5	87.5	93.8
Aasad	76.3	113.8	87.5	92.5	92.5
Shrawan	97.0	102.5	99.5	104.5	100.9
Bhadra	87.0	93.8	86.3	80.0	86.8
Aaswin	47.5	53.8	47.5	55.0	50.9
Kartik	58.8	73.8	56.5	68.7	64.4
Mangsir	69.3	77.5	85.0	78.8	77.6
Paush	67.5	77.5	72.5	61.3	69.7
Magh	76.3	82.5	71.3	72.5	75.6
Falgun	97.5	105.0	91.3	91.3	96.3
Chaitra	80.0	101.3	98.8	87.5	91.9
Mean of month	78.6	90.2	82.0	82.8	
Grand mean	83.4				
F-test	Ns				
CV, %	21.7				
$LSD_{0.05}$	25.24				

Conclusion

Based on the result of the 2070/71, the highest grain yield was produced from the hybrid genotype of RML-4/RML-17 (6894 kg/ha) planted in Asad and 6649kg/ha in Falgun planting followed by RML-32/RML-17 (6520 kg/ha) in Falgun and 6517 kg/ha in Bhadra planting. The ACROSS-9944/9942 produced highest grain yield 5723 kg/ha in Bhadra and S99TLYQ-B (4198 kg/ha) in Falgun planting. Comparatively lowest yields were produced by all the genotype planted during Mangsir and Paush. The longest maturity days were found ranging from 157 to 160 days during Bhadra planting and shortest days to maturity were found ranging from 80 to 83 days of all the varieties in Chaitra planting.

2.2.8 Evaluating the Performance of hybrids and OPVs of maize under tillage and no tillage with residue in the Terai during 2014/15

Methodology

The study aimed to identify the appropriate genotype of maize under with and under various conservation agriculture based crop management practices. Altogether 8 treatments consisting of four maize varieties namely; RML-32/RML-17, RML-4/RML-17, S99TLYQ-B and Rampur composite, and two levels of tillage (i.e., conventional and no tillage with residues management) were tested in 3 replication under split- split plot design.

Maize seeds were planted in each row with 2 seeds /hill and were maintained single plant per hill by thinning extra plants on 4th week of planting. The fertilizer dose was 120:60:40 kg NPK/ha along with 10 ton FYM/ha. Half dose of nitrogen, full dose of phosphorous (P2O5) and potash was applied at in planting time as a basal dressing alongside the maize rows and remaining half dose of nitrogen was side dressed in two split doses half on knee high stage and half on tasseling stage. Two weeding cum inter cultures at 22 and 42 DAS and two irrigation at knee high stage and grain filling stage was given. Carbofuran @ 2-3 granules per plant against stem borer was applied at knee high stage.

Observations were taken on, days to tasseling, days to silking, plant and ear height in cm, thousand grain weight, grain yield and stover yield.

Results

Phenological observation

The ANOVA revealed that the interaction effect of tillage and varietals were found highly significant difference for silking, tasseling, grain yield, 1000 grain weight and significant for stover yield but non significant results were found for plant & ear height (Table 77).

Days to tasseling

Days to tasseling was recorded from tassel emergence to 50% of plants have tasseled in each plot. The effect of tillage on days to tasseling was found highly significant result, where, crop took longer period to tasseling was found slightly more in no tillage with residue kept (60.83 days) as compared to conventional tillage with residue (58.58 days). The effect of genotype on days to 50% tasseling was highly significant. The variety RML-32/RML-17 was found delayed (63.33 days) as compared to other three varieties, Shortest tasseling days was found in Rampur composite 54.83 days (Table 77).

Days to silking

The same rows as that of tasseling records were taken for days to silking. In this experiment, the effect of tillage and variety on days to silking was found highly significant. The duration of silking was found slightly longer in no tillage with residue plot (64.00 days) as compared to conventional tillage plots (61.92 days). RML-4/RML-17 was slightly late in silking duration (66.83) as compared to other varieties that ranged from 58.67 to 63.33 days (Table 77).

Plant height

The effects of tillage on plant and ear height were found no significant result, where the plant height was slightly taller in C. Tillage (179.2cm) than no tillage with residue plot (177.5cm). Among the varietals, R. Composite was found tallest (183.2 cm) and RML-32/RML-17 has short plant height (172.5) as compared to others (Table 77).

Grain yield

The interaction effect of varieties and tillage on grain yield was no significant results but the highest grain yield was obtained from Rampur Composite (6298kg/ha) followed by RML-32/RML-17 (5980 kg/ha) under no tillage with residues kept plot than in conventional tillage. The lowest yield was found in S99TLYQ-B (3231 kg/ha) under conventional tillage than no tilled plot (4126 kg/ha).The hybrid varieties had comparatively low yielded due to suffering from Tersicum leaf blight during this season (Table 77).

Table 77. Effects of tillage and variety on days to tasseling, silking plant height, ear height and yield at NMRP, Rampur, Chitwan, during spring 2014

Treatments	Days to 50% Tasseling	Day to 50% silking	Plant height (cm)	Ear height (cm)	Grain Yield (kg/ha)	1000 Grain Wt (gm)	Stover Yield kg/ha
Factor: A							
No Tillage	60.83	64.00	177.5	89.2	5763	363.0	3837
C. Tillage	58.58	61.92	179.2	85.0	5044	399.7	3236
Mean	59.71	62.96	178.3	87.1	5292	381.3	3536
F-test(>0.05)	0.044	0.089	0.632	0.474	0.165	<.001	0.129
Factor: B							
RML-32/RML-17	60.83	63.33	172.5	81.7	5763	358.0	3175
RML-4/RML-17	63.33	66.83	180.0	88.3	5661	367.3	3803
S99TLYQ-B	59.83	63.00	177.5	80.0	3673	380.0	2785
Rampur Composite	54.83	58.67	183.3	98.3	6072	420.0	4382
Mean	59.71	62.96	178.3	87.08	5292	381.3	3536
F-test	<.001	0.002	0.194	0.138	<.001	<.001	0.042
$LSD_{0.05}$	4.359	4.896	14.6	24.28	1454.3	33.98	1599.6
CV%	4.2	4.4	4.7	15.9	15.7	5.1	25.8
A×B F-test	0.187	0.421	0.728	0.858	0.901	0.243	0.252

Stover yield

All maize stems were harvested from the base from the net harvested area and weighted immediately after harvesting. Husk is also included while taking Stover yield. Stover yield was calculated on hectare basis in Kg ha-1. The effect of tillage and variety on Stover yield was significant. Where the highest stover yield was obtained from Rampur Composite (5.043 tone /ha) under conventional tillage followed no tillage with residue kept condition. Comparatively hybrid varieties and Rampur Composite had more stover yield under conventional tillage than no tillage with residues but the S99TLYQ-B had more stover yield under no tillage with residue kept plot (Table 78).

Table 78. Interaction effect between tillage, and variety on No Grain and stover yield /ha at NMRP, Rampur, during spring, 2014

Interaction A x B	Tillage(A)			
	Grain yield kg /ha		Stover yield kg/ha	
Variety (B)	No Tillage with Residue	Conventional tillage	No Tillage with Residue	Conventional tillage
RML-32/RML-17	5980	5545	2650.	3700.
RML-4/RML-17	5760	5563	3420.	4187.
S99TLYQ-B	4126	3221	3153.	2417.
Rampur composite	6298	5845	3720	5043.
Grand Mean	5292		5336	
F-test (>0.05)	0.901		0.042	
CV%	15.7		25.28	

Conclusion

The highest grain yield in a hectare of land was found in Rampur Composite (6298 kg/ha) and RML-32/RML-17 (5980 kg/ha) under no tillage with residues kept plot followed by Rampur Composite 5845 kg/ha in conventional tillage during 2071 winter, at NMRP, Rampur. Rampur Composite and RML-32/RML-17 hybrid performed well during winter season under no tillage with residue retention in Terai region of Nepal.

2.3 Soil Science

2.3.1 Nitrogen consumption of Arun1 EV early maturing maize variety

Materials and Methods

The experiment was conducted in the research field of NMRP Rampur during the summer of 2014. Early maturing maize varietyArun-3 (Arun1-EV) was selected for the research purpose.Nitrogenous fertilizers are sensitive fertilizer as it leaches as well as volatilizes from the soil. Therefore, it is important to apply this fertilizer in different split dozes to minimize the losses from the soil. Five different times for fertilizer application was selected while conducting the field experiment viz. 1) basal application of 60 kg N/ha and 60 kg N/ha at 45 days after sowing (DAS), 2) 40 kg N/ha basal, 40 kg N/ha each at 45 and 60 DAS, 3) 30 kg N/ha basal, 30 kg N each at 30, 45, and 60 DAS, 4) 30 kg N/ha each at 30, 45, 60, and 75 DAS, and 5) Control (application of 10 ton FYM/ha). The experiment was laid out in factorial randomized complete block design with four replications. Plot size was 5m×4.5m and spacing was 75cm×25cm, row to row and plant to plant respectively.

Findings

The experimental data revealed that days to tasseling, days to silking, plant height (cm), ear height (cm) and 1000 kernels weight (gram) differed significantly. Effect of N fertilizer application timings was also clearly observed. A mixed result was observed for interaction effect between fertilizer application timings and growing season.

In summer season, there was no significant different on grain yield. Basal application of 60 kg N/ha and top dressing of 60 kg N/ha at 45 days after sowing (2534 kg/ha) gave the highest grain yield among the tested N fertilizer timings. Detail of the research result is presented in the table 79.

2.3.2 Updating fertilizer dose for hybrid maize

Research was conducted at NMRP, Chitwan. Pipeline hybrids RML32 X RML17 were selected for experimental purpose. Hybrid maize was planted in 6 rows of 3m long and spacing was 60cm×25cm. Outer two rows were used as border line and inner four rows were harvested for grain yield and other yield attributing parameters. N fertilizer will be applied 25% at planting, and remaining 75% in three split at knee height, tasseling, and dough stage. P and K fertilizer were applied at planting time. Treatments were tested in full factorial RCB design with three replications. Treatments consist four level of Nitrogen (120,160, 200 and 240 kg/ha) two level of Phosphorous (60 and 90 kg/ha) and two level of Potash (40 and 60 kg/ha).

Table 79. Average of yield and yield attributing characters of maize genotype Arun-3 as affected by different split dozes of nitrogenous fertilizers during summer seasons of 2014 at Rampur, Chitwan, Nepal.

SN	Name of the treatments	Days to tasseling	Days to silking	Plant Height (cm)	Ear Height (cm)	1000 grain weight (gram)	Grain yield (kg/ha)
1	60 kg N/ha basal and 60 kg N/ha at 45 DAS	45.5	49.3	145.8	71.5	240.5	2534.3
2	40 kg N/ha basal, 40 kg N/ha each at 45 and 60	45.0	48.5	134.0	67.3	239.4	2501.5
3	30 kg N/ha basal, 30 kg each at 30, 45, and 60	45.5	49.5	150.0	73.0	235.9	2135.0
4	30 kg N/ha each at 30, 45, 60, and 75 DAS	44.8	48.5	141.8	71.5	237.5	1761
5	Control	51.3	60.3	111.0	60.5	195.5	1782
	Mean	46.4	51.2	137	68	229.8	2142.7
	P value	**	**	**	**	*	0.107
	$LSD_{0.05}$	2.34	1.89	12.3	4.10	21.64	742.5

Findings

There was no significant difference among the treatments for all the tested parameters. The grain yield ranged from 7633kg/ha (200:60:40 NPK kg/ha) to 9327 kg/ha (160:60:60). The detail of the research result is presented in the table 80.

Table 80. Average of yield and yield attributing characters of hybrid maize RML 32×RML 17 as affected by different dozes of fertilizers during winter seasons of 2014 /015 at Rampur, Chitwan, Nepal (175 masl)

SN	Name of the treatments	Days to tasseling	Days to silking	Plant Height (cm)	Ear Height (cm)	1000 grain weight (gram)	Grain yield (kg/ha)
1	120:60:40 NPK kg/ha	65.7	70.3	137.3	68.7	311.7	8116
2	120:60:60 NPK kg/ha	66.0	70.7	141.0	70.0	369.1	8098
3	120:90:40 NPK kg/ha	67.7	72.0	149.3	74.0	361.0	8199
4	120:90:60 NPK kg/ha	66.0	70.3	138.3	69.0	325.0	8645
5	160:60:40 NPK kg/ha	67.7	73.0	150.3	72.0	333.8	8053
6	160:60:60 NPK kg/ha	66.3	70.7	150.0	72.0	322.3	9327
7	160:90:40 NPK kg/ha	66.0	70.7	140.3	70.3	351.4	8810
8	160:90:60 NPK kg/ha	65.0	69.7	156.7	74.3	351.8	9190
9	200:60:40 NPK kg/ha	69.3	74.3	147.7	74.7	340.2	7633
10	200:60:60 NPK kg/ha	69.3	74.3	126.7	79.0	345.1	8539
11	200:90:40 NPK kg/ha	68.0	73.0	149.7	75.0	355.5	7767
12	200:90:60 NPK kg/ha	67.3	71.7	138.7	69.0	325.2	8241
13	240:60:40 NPK kg/ha	66.3	70.3	149.7	74.3	327.9	8167
14	240:60:60 NPK kg/ha	67.3	72.7	145.0	71.0	351.8	7778
15	240:90:40 NPK kg/ha	67.7	71.7	148.3	74.7	337.5	8470
16	240:90:60 NPK kg/ha	67.0	71.7	138.0	69.7	358.4	8946
		67.0	71.7	144.2	72.4	341.7	8374
	$LSD_{0.05}$	2.96	2.60	28.19	8.91	39.93	1772.18
	P value	ns	Ns	Ns	ns	Ns	ns

2.3.3 Fertilizer management for pipeline inbreds RML96, RML95 and RML4

Materials and methods

Three maize inbred linesRML 96, RML 95 and RML 4 was selected for experimental purpose. Inbreds were planted in four rows of 3.75 meter long plot size and spacing 60cm×25cm in winter season. Outer two rows were used as border line and inner two rows for grain yield and other yield attributing parameters.

Four different doses of major chemical fertilizer were applied to inbred lines while conducting the field experiment viz.1)120 kg N, 60 kg P_2O_5 and 40 kg K_2O, 2) 120 kg N, 90 kg P_2O_5 and 40 kg K_2O, 3) 150 kg N, 60 kg P_2O_5 and 40 kg K_2O 4) 150 kg N, 90 kg P_2O_5 and 40 kg K_2O 5) 180 kg N, 60 kg P_2O_5 and 40 kg K_2O 6) 180 kg N, 90 kg P_2O_5 and 40 kg K_2O.Inbreds were planted during the winter season of 2014/015.

Findings

There was statistically significant difference for tasseling days. There were no significant difference on other parameters among the treatments due to inbreds and fertilizer applications.

The highest grain yield of inbred RML96 was found with the application of 180:90:40 NPK kg/ha (701 kg/ha). Similarly, the highest grain yield of inbred RML95 was found with the application of 150:60:40 NPK kg/ha (844 kg/ha) and highest grain yield of inbred RML4 was found with the application of 120:90:40 NPK kg/ha (627 kg/ha). Details of the research results are presented in the following tables (Table 81, 82 and 83).

Table 81. Average of yield attributing characters of inbred lines RML96, RML95 and RML4 as affected by different dozes of fertilizers during winter seasons of 2014 /015 at Rampur, Chitwan, Nepal. (175 meters above sea level)

Treatments	Days to tasseling			Mean	Days to silking			Mean	Plant ht (cm)			Mean
	RML96	RML95	RML4		RML96	RML95	RML4		RML96	RML95	RML4	
120:60:40 NPK kg/ha	71.66	72	74.66	72.77	74.66	75	78.33	76	76.66	91.66	88.66	85.66
120:90:40 NPK kg/ha	74.66	72.66	74	73.77	78	76.66	77.33	77.33	86.66	94.33	90.33	90.44
150:60:40 NPK kg/ha	71.66	73	74.66	73.11	75.33	76.66	78.33	76.77	84.33	90.66	91.33	88.77
150:90:40 NPK kg/ha	71.33	72.33	74.33	72.66	75.33	76	78.33	76.55	95	87.41	84	88.80
180:60:40 NPK kg/ha	71	72	75	72.66	74.33	76	78.66	76.33	90.66	86.66	84.33	87.22
180:90:40 NPK kg/ha	72	73.33	72.33	72.55	76.66	77.33	76	76.66	85	92	94	90.33
Mean	72.05	72.55	74.16	72.92	75.7	76.5	77.83	76.67	86.38	90.45	88.77	88.53
P value (fertilizer)				ns				ns				ns
P value (variety×fertilizer)				*				ns				ns
LSD (variety×fertilizer)				2.48				2.86				10.92
CV , %				2.1				2.3				7

Table 82. Average of yield attributing characters of inbred lines RML96, RML95 and RML4 as affected by different dozes of fertilizers during winter seasons of 2014 /015 at Rampur, Chitwan, Nepal. (175 meters above sea level)

Teatments	Ear ht (cm)			Mean	Ear length (cm)			Mean	Kernel row/ear			Mean
	RML96	RML95	RML4		RML96	RML95	RML4		RML96	RML95	RML4	
120:60:40 NPK kg/ha	39	46.33	45.33	43.55	9.06	10.26	9.2	9.51	7.13	10.06	10.4	9.2
120:90:40 NPK kg/ha	43	48.33	53.33	48.22	9.8	9.33	9.11	9.41	10.6	10.8	10.93	10.77
150:60:40 NPK kg/ha	42.66	47	46.66	45.44	8.33	10.33	8.63	9.1	10.73	10.13	9.8	10.22
150:90:40 NPK kg/ha	47	44.08	42.33	44.47	9.53	10	9	9.51	10.66	10.76	10.46	10.63
180:60:40 NPK kg/ha	47	45.83	43.86	45.56	9	7.83	9.53	8.78	11	10.33	11.43	10.93
180:90:40 NPK kg/ha	44.66	46.11	47.5	46.09	10.13	9	10.1	9.74	11.33	10.26	12	11.2
Mean	43.88	46.27	51.94	47.36	9.30	9.45	9.26	9.33	10.24	10.39	10.83	10.48
P value (fertilizer)				ns				ns				ns
P value (variety×fertilizer)				ns				ns				ns
LSD (variety×fertilizer)				8.28				1.74				2.21
CV , %				11				11.2				12.7

Table 83. Average of yield and yield attributing characters of inbred lines RML96, RML95 and RML4 as affected by different dozes of fertilizers during winter seasons of 2014 /015 at Rampur, Chitwan, Nepal. (175 meters above sea level)

Teatments	Kernals / row			Mean	Grain yield (kg/ha)			Mean
	RML96	RML95	RML4		RML96	RML95	RML4	
120:60:40 NPK kg/ha	18.13	21.5	19.66	19.76	594.17	620.42	369.52	528.04
120:90:40 NPK kg/ha	20.16	18.8	18.8	19.25	394.03	743.09	627.18	588.1
150:60:40 NPK kg/ha	17.13	21.26	18.53	18.97	448.52	844.21	494.36	595.7
150:90:40 NPK kg/ha	20.23	19.95	19.13	19.77	284.43	586.23	394.52	421.72
180:60:40 NPK kg/ha	19.42	17	19.53	18.65	575.23	549.35	432.26	518.95
180:90:40 NPK kg/ha	21.06	18.41	20.91	20.12	701.46	637.85	208.33	515.88
Mean	19.35	19.48	19.42	19.41	500	663.52	421.03	528.07
P value (fertilizer)				ns				ns
P value (variety×fertilizer)				ns				ns
LSD (variety×fertilizer)				3.92				442.043
CV , %				12.2				50.5

2.3.4 Nitrogen consumption of S99TLYQ-B full season maize

Materials and Methods

The experiment was conducted in the research field of NMRP Rampur during the summer season of 2014. Nitrogenous fertilizers are more sensitive fertilizers as it leaches as well as volatilizes from the soil. Therefore, it is important to apply this fertilizer in different split dozes to minimize the losses from the soil. Pipeline variety S99TLYQ-B was selected for the research as this variety is going to be released soon. Five different times for fertilizer application during maize growing period was selected while conducting the field experiment viz. 1) basal application of 60 kg N/ha and 60 kg N/ha at 45 days after sowing (DAS), 2) 40 kg N/ha basal, 40 kg N/ha each at 45 and 60 DAS, 3) 30 kg N/ha basal, 30 kg N each at 30, 45, and 60 DAS, 4) 30 kg N/ha each at 30, 45, 60, and 75 DAS, and 5) Control (application of 10 ton FYM/ha and no chemical fertilizers). The experiment was laid out in factorial randomized complete block design with four replications. Plot size was 5m × 4.5m and spacing was 75 cm × 25 cm row to row and plant to plant respectively.

Table 84. Average yield and yield attributing characters of maize genotype S99TLYQ-B as affected by different split dozes of nitrogenous fertilizers during summer season of 2014 at Rampur, Chitwan, Nepal.

SN	Treatment	Days to tasseling	Days to silking	Plant Height (cm)	Ear Height (cm)	1000 grain weight (gram)	Grain yield (kg/ha)
1	60 kg N/ha basal and 60 kg N/ha at 45 DAS	71.5	76.5	170	92.7	372.2	5860
2	40 kg N/ha basal, 40 kg N/ha each at 45 and 60	72.7	77.7	172	88.5	343.2	4927.5
3	30 kg N/ha basal, 30 kg each at 30, 45, and 60	72.2	76.7	170	88.2	358.5	5469.4
4	30 kg N/ha each at 30, 45, 60, and 75 DAS	72.5	76.7	177	93.2	318.2	5686.6
5	Control	74	80	106	54.7	248.1	2294.6
	Mean	72.6	77.55	159.4	83.5	328.07	4847.6
	$LSD_{0.05}$	1.37	2.34	7.31	6.95	56.59	580.21
	P value	0.024	0.037	**	**	**	**

Findings

The experimental result revealed that plant height (cm), ear height (cm), ear length (cm) and 1000 grains weight (gram), differed significantly on summer season. Significant effect of N fertilizer application timings on grain yield was clearly observed in this experiment. There was significant different on grain yields. Regarding the grain yield due to frequency of nitrogen application timings, there was significant different among different treatments. Basal application of 60 kg N/ha and side dressing of 60 kg N/ha at 45 days after sowing gave the highest grain yield (5860 kg/ha). Similarly, application of 30

kg N/ha basal and side dressing of 30 kg N each at 30, 45, and 60 DAS (5687 kg/ha) were found better practice among the tested N fertilizer timings. Details of the research result are presented in the table 84.

2.3.5 Variety cum fertilizer trial (VCFT) on maize

Materials and methods

Recommendation of fertilizer for maize depends upon variety. Hybrid varieties need more fertilizer as compared to improved varieties. NMRP had recommended 120:60:40 kg NPK kg / ha for all types of maize varieties .This experiment aims for appropriate and economic dose of fertilizer for different maize genotype. Experiment was conducted at NMRP Rampur, situated in the Chitwan district. Four different maize genotype (RML32 × RML17, RML4 × RML17, Across 9331 and S99TLYQ-B) were used. Plot size was 12 sq.m (4 rows of 4m long) and spacing was 25 cm × 75 cm. Four different doses of major chemical fertilizer were applied to hybrid and full season maize varieties while conducting the field experiment viz.1) Control (application of 10 ton FYM/ha and no chemical fertilizers), 2)120 kg N, 60 kg P2O5 and 40 kg K2O, 3) 180 kg N, 90 kg P2O5 and 60 kg K2O, 4) 150 kg N, 75 kg P2O5 and 90 kg K2O. Maize was planted during the winter season of 2014/015. This experiment was conducted in split plot design with three replications.

Findings

There was statistically significant difference for plant and ear height (cm), kernel rows/ear (no.), no. of kernels per row, ear length (cm), 1000 grain weight and grain yield (kg/ha) among the treatments due to variety and fertilizer applications.There was no significant difference due to interaction effect of variety and fertilizer applications for all the tested parameters.

The highest grain yield was found with the application of 180:90:60 NPK kg/ ha (6777 kg/ha) followed by the application of 120:60:40 NPK kg/ha (5305 kg/ha). Regarding the performance of maize genotype the highest grain yield was produced by the genotype RML4 × RML17 (5288 kg/ha) followed by the genotype RML32 × RML17 (5151 kg/ha). Details of the research result are presented in the tables 85, 86, 87 and 88.

Table 85. Average of yield and yield attributing characters of different maize genotype as affected by different dozes of fertilizers during winter seasons of 2014 /015 at Rampur, Chitwan, Nepal (175 meters above sea level)

Treatments	DT (days)					DS (days)				
	RML32 × RML17	RML4 × RML17	Across9331	S99TLYQ-B	Mean	RML32 × RML17	RML4 × RML17	Across9331	S99TLYQ-B	Mean
0:0:0 NPK kg/ha	69.66	74.66	62	70	69.16	74.66	78.33	67.66	74.33	73.75
120:60:40 NPK kg/ha	68	74	56	67	66.41	72	78.33	62.66	71.66	71.16
180:90:60 NPK kg/ha	67	74	59	68	67.25	71	75	64.33	72.66	70.75
150:75:90 NPK kg/ha	69	74	57	67	67.09	73.66	78	63	73	72.08
Mean	68.58	74.41	58.75	68.18	67.48	72.83	77.41	64.41	73.08	71.93
P value (variety)					**					**
P value (fertilizer)					ns					ns
P value (variety×fertilizer)					ns					ns
LSD (fertilizer)					1.836					1.984
LSD (variety×fertilizer)					3.673					3.968
CV , %					3.3					3.3

Table 86. Average yield attributing characters of different maize genotype as affected by different dozes of fertilizers during winter seasons of 2014 /015 at Rampur, Chitwan, Nepal (175 meters above sea level)

SN	Treatments	Plant Height (cm)					Ear Height (cm)					Ear Length (cm)				
		RML32 × RML17	RML4 × RML17	Across9331	S99TLYQ-B	Mean	RML32 × RML17	RML4 × RML17	Across9331	S99TLYQ-B	Mean	RML32 × RML17	RML4 × RML17	Across 9331	S99TLYQ-B	Mean
1	0:0:0 NPK kg/ha	92	82.66	112.33	109	99	38	43	68	65	53.75	10	9	11	9	9.91
2	120:60:40 NPK kg/ha	148	157	179.33	167.33	162.91	72	76	83	80	18.16	13	13.66	13.33	13	13.25
3	180:90:60 NPK kg/ha	149.33	147	175	170	160.41	75	79	88	84	81.91	12.66	13.33	13.66	13	13.16
4	150:75:90 NPK kg/ha	152	162	179.66	166.33	165	75	80	88	82.33	81.33	114	13	13	14	13.66
	Mean	135.33	137.16	161.66	153.16	146.83	65.16	69.75	82.08	78.16	73.79	12.41	12.58	12.75	12.25	12.5
	P value (variety)					**					**					0.709
	P value (fertilizer)					**					**					**
	P value (variety×fertilizer)					ns					ns					ns
	LSD (fertilizer)					7.45					6.078					0.907
	LSD (variety×fertilizer)					14.9					12.156					1.814
	CV , %					6.1					9.9					8.7

Table 87. Average of yield attributing characters of different maize genotype as affected by different dozes of fertilizers during winter seasons of 2014 /015 at Rampur, Chitwan, Nepal (175 meters above sea level)

SN	Treatments	Kernel rows/ear (no.)					Kernel/row (no.)					1000 grain weight (gram)				
		RML32 × RML17	RML4×RML17	Across9331	S99TLYQ-B	Mean	RML32×RML17	RML4×RML17	Across9331	S99TLYQ-B	Mean	RML32×RML17	RML4×RML17	Across 9331	S99TLYQ-B	Mean
1	0:0:0 NPK kg/ha	11.66	12.66	14	14	13.08	21	20.33	22	21	21.08	250.12	329	321.95	268.07	292.29
2	120:60:40 NPK kg/ha	12.66	13.33	14.66	14.66	13.83	28.33	28	27.66	29.66	28.41	324.69	372.77	339.45	354.79	347.93
3	180:90:60 NPK kg/ha	13	13.33	13.66	14	13.50	28	29	28	30	28.75	359.44	383.54	379.29	309.44	357.93
4	150:75:90 NPK kg/ha	12.66	12.66	16	14	13.83	28	30	26.33	32.33	29.76	336.66	378.68	371.81	325.11	353.07
	Mean	12.5	13	14.58	14.16	13.56	26.33	26.83	26	28.25	26.854	317.73	366	353.12	314.35	337.81
	P value (variety)					**					ns					ns
	P Value (fertilizer)					ns					**					*
	P value (variety×fertilizer)					ns					ns					ns
	LSD (fertilizer)					0.59					2.674					38.356
	LSD (variety×fertilizer)					1.18					5.348					76.713
	CV ,%					5.2					11.9					13.6

Table 88. Average of yield of different maize genotype as affected by different dozes of fertilizers during winter seasons of 2014 /015 at Rampur, Chitwan, Nepal (175 meters above sea level)

SN	Treatment	Grain Yield (kg/ha)				
		RML32 × RML 17	RML4 × RML17	Across 9331	S99TLYQ-B	Mean
1	0:0:0 NPK kg/ha	1873	2896	2152	2717	2410
2	120:60:40 NPK kg/ha	6011	6115	3888	5208	5305
3	180:90:60 NPK kg/ha	6853	6192	4887	6778	6777
4	150:75:90 NPK kg/ha	5865	5949	4471	4926	5303
	Mean	5151	5288	3850	4907	4799
	P value (fertilizer)					ns
	P value (variety)					**
	P value (variety×fertilizer)					ns
	LSD (fertilizer)					861.378
	LSD (variety×fertilizer)					1722.76
	CV,%					21.5

2.4 Plant Pathology

Introduction

Maize is staple food of hill people and seventy percent of maize is produced in mid hills region (900-1500 masl) and a further eight percent is produced in high hills (1500-22 masl) and remaining 22% is produced in Terai and inner terai (<900 masl). In world wide about 20% of maize grain yield is reduced due to major diseases of maize. Recently the recorded major maize diseases in Nepal are gray leaf spot (GLS), turcicum leaf blight (TLB), southern leaf blight (SLB), banded leaf and sheath blight (BLSB), stalk rot complex and ear rot. Maize genotype both received from CIMMYT and NMRP developed OPVs, hybrids, inbred and synthetics were evaluated in above mentioned diseases in the hot spots across the country. During 2014/15 summer season a total of 20 genotype both exotic (CIMMYT India) and NMRP developed were screened against GLS across the hill regions of Pakhribas, Dhungkharka and Salyan and for southern leaf blight (SLB) and banded leaf and sheath blight (BLSB) diseases 20 genotype were included for each screening nursery and were screened at Rampur. For ear rot screening nursery 21 and for northern leaf blight disease 25 maize genotype were included and screened at Rampur, respectively. Each experiment was screened under replicated conditions.

Methodologies

All experiments were conducted in RCB design with three replicated conditions with two rows of five meter long plot size. For banded leaf and sheath blight, turcicum leaf blight and ear rot diseases, all the plants were artificially inoculated using fresh culture multiplied in the laboratory. For scoring foliar diseases (TLB, SLB, GLS) the following scoring methods was employed.

Disease symptoms, severity scale and susceptibility reaction for foliar diseases (TLB, SLB, GLS etc)

Disease symptoms	Severity scale	Disease reaction/susceptibility class
Plants with one or two to few scattered lesions on lower leaves	1	Resistant
Moderate number of lesions on leaves, affecting less than 25 per cent of the area	2	Moderately resistant
Abundant lesions on lower leaves, few on other leaves affecting 26-50% leaf area	3	Moderately susceptible
Lesions abundant on lower and mid leaves, extending to upper leaves affecting 51-75% leaf area	4	Susceptible
Lesions abundant on almost all leaves, plant prematurely dried or killed with 76-100% of the leaf area affected	5	Highly susceptible

Disease symptoms, severity scale and susceptibility reaction BLSB disease using following disease scoring scale (CIMMYT system) is used

Disease symptoms	Severity scale	Disease reaction/susceptibility class
No infection	1	Resistant
Partial infection up to four leaf sheath and leaves	2	Moderately resistant
Heavy infection up to lower four leaf sheath and leaves partial on upper leaf sheath below the ear placement, no cob infection	3	Moderately susceptible
Heavy infection on all leaf sheath and leaves below the ear placement, partial infection on cobs	4	Susceptible
Complete rotting of cobs, very little or no grain formation, grain become chaffy or may be rotten	5	Highly susceptible

Disease symptoms, severity scale and susceptibility reaction for ear rot disease the following scoring scale (Reid & Hamilton, 1996) is used

Disease symptoms	Severity scale	Disease reaction/susceptibility class
Ears without ear rot symptoms	1	Immune
Ears with 1-3% kernels diseased	2	Highly resistant
Ears with 4-10 % kernels diseased	3	Resistant
Ears with 11-25 % kernels diseased	4	Moderately resistant
Ears with 26-50% kernels diseased	5	Moderately susceptible
Ears with 51-75% ears diseased	6	Susceptible
Ears with >76% to 100% kernels diseased	7	Highly susceptible

2.4.1 Gray leaf spot (GLS)

This disease is caused by the fungus *Cercospora zeae maydis* and is the main devastating disease of maize crop in the hills of Nepal. To combat the disease maize genotype were screened in different hill stations and the result concluded from Pakhribas that the genotype P501SRCO/P502SRCO was recorded for resistant (1.3) reaction and three genotype 05SADVI, Entry # 36 and Entry # 27 were responded for MR reaction (Table 89). In case of Dhungkharka nine genotype namely; ZM-401, ZM-627, 05SADVI, 07SADVI, TLBRSO7F16, ENTRY#33, ENTRY#24, ENTRY#32 and ENTRY#21 were recorded for MR reaction (Table 90). The tested genotype at Salyan revealed that six genotype namely; 05SADVI, 07SADVI, ACROSS-9942/ACROSS-9944, BGBYPOP, ENTRY # 24 and ENTRY# 32 were reacted resistant reaction and the genotype 07SADVI produced significantly highest grain yield (8638 kg/ha) (Table 91).

Table 89. Gray leaf spot disease reaction on genotype of maize at Pakhribas 2014

SN	Genotype	GY kg/ha	Severity (1-5)	Reaction
1	ZM-401	1698	3.3	MS
2	ZM-627	2290	2.8	MS
3	05SADVI	74	3	MS
4	05SADVI	1007	2.3	MR
5	TLBRSO7F16	829	3	MS
6	P501SRCO/P502SRCO	1615	1.3	R
7	AC9942/AC9944	762	3	MS
8	BGBYPOP	632	3	MS
9	ENTRY#33	963	2	MR
10	ENNTRY#24	1392	3	MS
11	ENTRY#36	588	2.5	MR
12	ENTRY#27	306	1.3	MR
13	RAMS03F08	1937	2.8	MS
14	ENTRY#28	881	3	MS
15	ENRTY#34	1355	3.3	MS
16	ENRTY#32	1182	3	MS
17	ENTRY#21	1001	3	MS
18	RML-32/RML-17	587	3	MS
19	MANAKAMANA-3	1136	3	MS
20	Farmer's Variety	1279	3.3	MS
	Grand mean	1076	2.7	
	F-test	Ns	ns	
	CV%	32.8	26.8	
	LSD(0.05)	1414	1.5	

Table 90. Gray leaf spot disease reaction on genotype of maize at Dhungkharka, 2014

Trt. No.	Pedigree	GY kg/ha	Severity (1-5)	Reaction
1	ZM-401	3760	2.5	MR
2	ZM-627	6932	2	MR
3	05SADVI	4075	2.5	MR
4	07SADVI	5266	2	MR
5	TLBRSO7F16	2268	2	MR
6	P501SRCO/P502SRCO	1979	3.5	MS
7	AC9942/AC9944	3798	2.8	MS
8	BGBYPOP	3188	2.8	MS
9	ENTRY#33	2327	2.5	MR
10	ENTRY#24	2423	2.5	MR
11	ENTRY#36	1903	3.5	MS
12	ENTRY#27	3091	3.3	MS
13	RAMSO3F08	3770	2.8	MS
14	ENTRY#28	2244	2.8	MS
15	ENTRY#34	2982	3.1	MS
16	ENTRY#32	2570	2.3	MR
17	ENTRY#21	2934	2.5	MR
18	RML-32/RML-17	2680	2.8	MS
19	Manakamana-3	2496	3.8	S
20	Dhungkhark local	3608	4.5	S
	Grand mean	3215	2.8	
	F-test	**	**	
	CV%	23.9	10.3	
	$LSD_{0.05}$	1606	0.6	

Table 91. Gray leaf spot disease reaction on genotype of maize at Salyan, 2014

Trt, No.	Pedigree	GY kg/ha	Severity (1-5)	Reaction
1	ZM-401	8015	1.8	MR
2	ZM-627	8745	1.8	MR
3	05SADVI	7995	1.3	R
4	07SADVI	8638	1.3	R
5	TLBRS07F16	5200	1.8	MR
6	P501SRCO/P502SRCO	5304	2.3	MR
7	AC9942/AC9944	7315	1.5	R
8	BGBYPOP	4753	1.5	R
9	ENTRY#33	7765	1.3	R
10	ENTRY#24	3628	1.8	MR
11	ENTRY#36	6446	2	MR
12	ENTRY#27	4876	2	MR
13	RAMSO3F08	5478	1.8	MR
14	ENTRY#28	4327	2	MR
15	ENTRY#34	5213	1.8	MR
16	ENTRY#32	8766	1.5	R
17	ENTRY #21	4472	1.8	MR
18	RML-32/RML-17	7175	2.8	MS
19	MANAKAMANA-3	7260	1.8	MR
20	Farmer's Variety	7823	2	MR
	Grand mean	6460	1.8	
	F-test	**	ns	
	CV%	17.6	21.1	
	$LSD_{0.05}$	2383	0.8	

2.4.2 Southern leaf blight

This disease is incited by the fungus *Helminthosporium maydis* and is a destructive disease in terai/innerterai at summer season. For the identification of source of resistance against this disease maize genotype were screened at Rampur and disease severity was recorded in three consecutive times (10 days interval) and none of the tested genotype showed resistant reaction up to third scoring (Table-92).

Table 92. Southern leaf blight disease reaction on genotype of maize at Rampur, 2014

SN	Genotype	SLB severity (1-5)			AUDPC	BLSB (1-5)	Height in cm		GY kg/ha
		1st	2nd	3rd			plant	ear	
1	Across 9331RE	3.2	4.2	5	61.7	1.8	77	155	1082
2	RampurS13F24	2.5	3	4.2	48.3	2.2	81	167	1715
3	R pop-3	2.3	3.7	4.5	52.5	2	86	155	2010
4	RampurS13F26	2.5	2.7	4	45.8	2.3	69	150	1614
5	BLSBRS07F12	2.7	3.5	4.5	53.3	1.8	83	164	1557
6	RampurS03F02	2.5	3.2	4.2	49.2	2.2	64	139	310
7	RML-4/RML-17	2	2.5	4.2	43.3	2	83	163	2211
8	ZM-401	2.3	2.8	4.5	48.3	2	70	150	1137
9	BGBYPOP	1.7	2.3	3.8	39.2	2	86	166	2469
10	RML-32/RML-17	1.7	2.3	4	40	1.5	81	161	2947
11	ZM-627	2.2	2.8	4.3	46.7	1.8	78	150	963
12	S99TLYQ-B	2.8	3.5	4.5	54.2	2.2	66	145	1125
13	Across9942/Ac9944	2.7	3.3	4.5	52.5	2	85	167	1802
14	BLSBRS07F10	1.8	2.8	4.7	46.7	2	87	164	2082
15	TLBRS07F16	2.2	3	4.2	46.7	1.7	91	172	2216
16	Terai pool yellow	3.3	3.8	4.8	60	2	89	164	1835
17	Upahar	2.5	3	4.3	49.2	2.2	77	150	1744
18	Rampur composite	2.5	3.3	4.5	51.7	1.7	97	175	2061
19	Arun-2	2.7	3.7	5	56.7	1.7	75	153	2379
20	Yellow pop corn	2.8	3.5	4.5	54.2	2	59	141	118
	Grand mean	2.4	3.2	4.4	50	1.95	79	158	1669
	F-test	**	**	**	**	ns	**	**	**
	CV%	14.4	11.8	5.4	7	18.8	9.9	6.7	29.6
	$LSD_{0.05}$	0.6	0.6	0.39	5.8	0.6	13	17.4	1206

2.4.3 Banded leaf and sheath blight disease

Banded leaf and sheath blight disease is caused by *Rhizoctonia solani*, a soil born disease of maize spreading terai to mid-hills regions and becoming a major threats for growing summer maize in these areas. For identification of source of resistance both exotic and NMRP developed maize genotype were evaluated at Rampur and RARS Lumle under artificially inoculated conditions. At Rampur none of the genotype were responded resistant to moderately resistant against this disease up to third scoring time (Table-93).

Table 93. Banded leaf and sheath blight disease reaction on genotype of maize at Rampur 2014

SN	Genotype	BLSB sev. (1-5)			SLB (1-5)	Height in cm		GY kg/ha
		1st	2nd	3rd		plant	ear	
1	BGBYPOP	2	2.7	3.8	2.2	170	85	1844
2	ENTRY#33	2	2.8	4.3	2.5	176	89	1337
3	ENTRY#24	2.5	3.5	4.7	2.5	159	76	1032
4	ENTRY#36	2.2	3.3	4.3	2.5	156	70	1119
5	ENTRY#27	2.2	3	4.5	2.3	161	73	1027
6	RAMS03F08	2.2	2.8	4.2	2.2	169	82	1856
7	ENTRY#28	2.3	3.5	5	2.8	148	65	1696
8	ENTRY#34	2.2	3	4.3	2.3	158	67	1315
9	ENTRY#32	2.5	3.3	4.5	2.2	176	92	1329
10	ENTRY#21	2.3	3.5	5	2.7	153	63	871
11	RML-32/RML-17	2	3.2	4.2	1.7	172	84	2864
12	ZM-401	2.5	3.7	4.5	2.2	163	78	1740
13	ZM-627	2.7	3.7	4.8	2.3	165	86	835
14	05SADVI	2.2	3.3	4.3	2.5	165	86	1522
15	07SADVI	2.5	3.7	4.3	2.2	168	81	1442
16	TLBRSO7F16	2	2.7	4	1.7	171	90	2990
17	P501SRCO/P502SRCO	2.7	3.7	4.8	2.5	153	72	1230
18	AC9942/AC9944	2.8	3.7	4.5	2.7	160	83	1319
19	MANAKAMANA-3	2.3	3.2	4.5	2	182	99	1999
20	F. LOCAL	2.5	3.3	4.7	2.7	169	83	2477
	Grand mean	2.3	3.3	4.5	2.3	165	80	1592
	F-test	*	**	**	ns	**	**	**
	CV%	12.4	10.5	5.7	18.2	5	9.1	30.3
	$LSD_{0.05}$	0.48	0.6	0.4	0.7	14	12	796.7

2.4.4 Ear rot disease

This disease is also a major disease of maize from terai to hills of Nepal. The disease is caused by a number of fungi but most common in terai and hills is caused by *Fusarium moniliformae* that not only reduced the grain yield but also deteriorate the quality of maize grain. To identify resistant/moderately resistant against this disease maize genotype were screened under artificial inoculated conditions at Rampur. Among the tested genotype RML-6/RML-7 was recorded for resistant (R) reaction and other ten genotype namely; RML-32/RML-17, RML-4/RML-17, Rampur hybrid-2, RL-4//RL-111, (RML-68/RL-101)/(RML-8/RML-62), KYM-33/KYM-35, RML-68/RL-101, (RML-174/RML-36)/(RML-6/RML-19), Rajkumar and Rampur composite responded moderately resistant (MR) reaction (Table-94).

Table 94. Ear rot disease reaction on genotype of maize at Rampur, 2014

SN	Genotype	% kernel rotten	Severity (1-7)	Reaction	Other diseases (1-5)		GY kg/ha
					BLSB	SLB	
1	RML-32/RML-17	13	4	MR	1.3	1.5	4018
2	RML-4/RML-17	22	4	MR	1.2	1.8	4357
3	RAMPUR HYBRID-2	19	4	MR	1.3	2.2	2408
4	RML-87/RL-105	33	5	MS	1.7	2.2	2207
5	RML-98/RL-105	32	5	MS	1.3	2	2173
6	RL-57/RL-189	32	5	MS	1.8	2.5	1689
7	RML-6/RML-7	7	3	R	1.3	1	655
8	RML-4/RL-111	13	4	MR	1.5	2	3600
9	(RML-68/RL-101)/(RML-8/RML-62	22	4	MR	1.7	2.5	464
10	KYM-33/KYM-35	15	4	MR	1.8	2.7	2047
11	RL-180/RL-105	35	5	MS	2	2.8	2542
12	RML-68/RL-101	18	4	MR	1.3	2	3346
13	RL-182/RL-197	29	5	MS	1.2	1.7	2727
14	ZM-401	27	5	MS	1.5	2.2	1425
15	ZM-621	35	5	MS	1.5	2	1041
16	05SADVI	27	5	MS	1.3	1.8	2074
17	07SADVI	31	5	MS	1.5	2.5	1548
18	(RML-174/RML-36)/(RML-6/RML-19)	11	4	MR	1.3	2	520
19	(RML-6/RML-19)/RML-84/RL-105)	44	5	MS	1	1.7	605
20	RAJKUMAR	20	4	MR	1.3	1.5	3423
21	RC	16	4	MR	1.7	2.5	2122
	Grand mean	23.9			1.5	2	2142
	F-test	*			ns	**	**
	CV%	48.5			25.2	22.3	37.7
	$LSD_{0.05}$	19.1			0.6	0.8	1334

2.4.5 Northern leaf blight disease

Northern corn leaf blight (NCLB) or turcicum leaf blight (TLB) is caused by the fungus *Exserohilum turcicum* (Pass), is an increasingly important disease in the winter and early spring seasons in the terai and inner terai as well as in the summer season in the hills of Nepal. For the identification of source of resistance, maize genotype were screened against this disease under inoculated conditions at Rampur with 25 maize genotype including yellow pop corn as a susceptible check and planted around the plot as a spreader row. None of the tested genotype reacted resistant (R) to moderately resistant (MR) but all the genotype reacted moderately susceptible (MS) to susceptible (S) against turcicum leaf blight disease and the check genotype yellow pop corn was highly susceptible (HS) to this disease which was totally collapsed due to this disease (Table-95).

Table 95. Northern leaf blight disease reaction on genotype of maize at Rampur, 2014

Trt. No.	Genotype	Severity (1-5)		AUDPC	Reaction
		1st	2nd		
1	RML-4	2.8	4	23	S
2	RML-32	2.5	3.8	22	S
3	NML-2	2.8	4.2	24	S
4	RML-17	2.8	3.5	20.7	MS
5	RML-95	2.7	4	23	S
6	RML-96	2.3	3.8	21.7	S
7	RL-105	4	4.8	28.3	S
8	RL-111	3.8	4.7	27.3	S
9	RML-85	3.3	4	23.7	S
10	RML-86	3.3	3.7	22	S
11	RML-19	2.8	3.5	20.7	MS
12	RML-84	4.2	4.8	28.7	S
13	RML-32/RML-17	1.7	3	17	MS
14	RML-4/RML-17	2	3	17.3	MS
15	RML-86/RL-105	2.3	4	22.7	S
16	RML-95/RML-96	2.7	4.2	23.7	S
17	RL-151/RL-111	2.2	3.7	20.7	S
18	07SADVI	2.2	3.5	20	MS
19	05SADVI	2.2	3.5	19.7	MS
20	ZM-401	2.3	3.8	22	S
21	ZM-627	2.7	3.7	21	S
22	TLBRS07F16	1.8	3.2	18	MS

Trt. No.	Genotype	Severity (1-5)		AUDPC	Reaction
		1st	2nd		
23	RC	2.2	3.5	20	MS
24	ARUN-2	3.5	4.2	24.7	S
25	YELLOW POP CORN	3.3	5	28.7	HS
	Mean	2.7	3.9	22.4	
	F-test	**	**	**	
	CV%	19.6	9.5	9.8	
	$LSD_{0.05}$	0.9	0.6	4	

2.5 Entomology

2.5.1 Evaluation of Trichogramma wasps to manage maize stem borer at NMRP Rampur

At NMRP Rampur, we used *Corcyra cephalonica* eggs for the purpose of mass rearing of the *Trichogramma chilonis*. In this regard, we used maize grit (2.5 kg), streptomycin (0.5 gm), yeast (5 gm) and ground nut powder (250 gm) per 1 ml (about 18,000) of Corcyra eggs. The diet ratio for rearing Corcyra moth is recommended by Nepal Agricultural Research Council, Entomology Division, Khumaltar. As a seed, two cards of Trichogramma were brought from the Entomology Division Khumaltar. Thereafter we multiplied the wasp at NMRP Rampur as required amount for the field release. The experimental field was prepared after having ploughing and adding compost manure. For each plot had 7 lines of 5m long (=26.2 m^2), and Arun-2, a short duration variety, was used. The crop geometry 25×75 cm^2 was maintained for each plot. There were four replications and, five treatments, in which two rates of 60,000 and 80, 000 trichogramma wasps were released per ha basis in two and three times of each dose of the wasps. A commercial insecticide Dimethoat 30 EC at the rate of 1.5 ml lit-1 of was as a check - and the design was randomize block. From the experiment, numbers of cobs per plot, grain weight, grain moisture, 1000 grain weight were taken into consideration. For borer damage parameters, 10 sampled plants of each treatment were taken and measured stem tunneling and exit holes count per plant.

Results

From the experiment, plant height, stem diameter, tunnel length per plant, number of exit holes per plant, number of cob harvested and test weight were recorded of each treatment. About 10.14 cm to 20.08 cm of tunnel length per plant were measured. Similarly, exit holes count per plant ranges from 3.13 to 5.03. All the measured parameters: plant heights, stem diameter, tunnel length, number of exit holes, number of cob harvested and test weight were similar based on the treatments provided (Table 96). Small plot size (about 26 m^2) coupled with none of the barrier between the plots being implemented in order to prevent wasps' movement from one plot to another plot might play a major role for getting similar results among the treatments. Additionally, newly hatched wasps have a high capacity of foraging so that it searched for host eggs without limiting the released plot. Although, the damage parameters were similar as per the treatment, we would conclude that the plot treated with Dimethoate would obviously superior in terms of human health and environmental perspective.

Table 96. Mean data of yield attributes and stem borer damage parameters

SN	Treatment	Plant height in cm	Stem diameter in cm	Tunnel length in cm	Number of exit hole	Number of cob/ plot	Test weight	Grain yield t ha^{-1}
1	Dimethoat 30 EC @ 1.5 ml/ lit	146.88	1.48	16.85	4.23	58.75	280.00	1.822
2	Trichogramma wasp @ 80,000 two times at 15 days interval	139.00	1.44	16.50	5.03	54.50	282.75	1.814
3	Trichogramma wasp @ 60,000 two times at 15 days interval	138.30	1.57	10.14	3.13	60.75	272.75	1.957
4	Trichogramma wasp 80,000 three times at 15 days interval	154.74	1.46	14.26	4.22	63.25	282.25	2.432
5	Trichogramma wasp @ 60,000 three times at 15 days interval	142.63	1.62	20.08	4.70	59.00	275.00	2.088
	p-value (0.05 level)	ns	ns	ns	ns	ns	ns	ns

2.5.2 Maize stem borer management

2.5.2.1 Relative susceptibility of maize genotype to Maize Stem Borer, Chilo partellus Swinhoe in the field condition

Materials and Method

An experiment composed of 40 elite maize genotype pulled from OPV, QPM and Hybrids including Arun 2, Rampur composite, Posilo makai 1 and Rampur hybrid-2 as a standard checks were evaluated in RCB design with three replications at NMRP, Rampur during 2071/72 spring season to find out the resistance source of maize stem borer, *Chilo partellus* Swinhoe (Lepidoptera: Pyralidae). Among the tested genotype, 21 were composed from OPV, 9 from QPM and 10 from Hybrid. The trial was seeded on 2071/11/25 (9 March, 2015) with a plot size of two rows of 5m length and spacing was 60 × 20 cm between row to row and plant to plant. Two rows of Rampur composite (white seeded release variety) were seeded all around the trial plots to facilitate enhancement of pests. All agronomical practices were done as per recommendation for good crop health. Observations like score (0-9 scale), total healthy and infested plants/plot, tunnel length and exit holes were followed as the system ascribed by CIMMYT, Mexico.

Result

Past experience at the locations indicated that maize stem borer infestation at NMRP, Rampur was observed more in spring season planting crop as compared to winter season. The same trend of damage was seen in present experiment. Range of visual score at vegetative stage was 1.6-5 score where as 1.3-3.6 score was recorded at tasseling stage. Thus majority of genotype were scored moderately resistant reaction (2-3 score) except RampurSO3F8 (5 score), S01SIWQ-3 (4.6 score), S03TLYQ-AB-02 (4 score), and R-POP-2 (4 score). Percent of damage by counting the total healthy and infested plants/plot was noticed more in young stage than tasseling stage. Range of percentage damage was varied from 16.2 to 51.2 % at knee high stage as compared to before tasseling stage (5.3-33.4%). Mean of two observations inferred that maximum infestation of 36.4 % was recorded which was moderately high range of damage by the pests. Furthermore, observation of tunnel length and exit holes were also found minimum range similar to that of other parameters (Table 97).

2.5.2.2 Effectiveness of conventional pesticides against maize borer management in field condition

Materials and Method

A field experiment composed of eight treatments including control was evaluated against maize stem borer at NMRP; Rampur during 2071/72. The experiment was laid in RCB design with three replications. RML-95/RML-96 (pipeline hybrid genotype) was used for the purpose. Individual plot size was 6 rows of 5m length and spacing was 60 cm between row to row and 20 cm plant to plant. Chemical fertilizer @150:80:60 kg NPK/ha was applied with two split dose of nitrogen at knee high and before tasseling stage. The trial was seeded on 2071/12/22 (5 April, 2015). All cultural operations were done as per recommendation for good crop health. Granular insecticide were applied at knee high stage in plant whorl where as liquid form of insecticides applied as foliar first at 15 days after emergence and second before tasseling stage. Observations like Damage score (0-9 scale), percent plant damage, Tunnel length and exit holes and grain yield were taken on time as ascribed by Ampofo and Saxena, CIMMYT.

Results

On hand data as depicted in table were analyzed and found that almost all parameters was differed significantly except tunnel length. Generally, incidence of maize stem borer in each parameters and corresponding their treatments was observed relatively more due to spring season planting at which congenial environment available to the pests. Moreover, pest population and subsequently their damage in plants were noted more in vegetative stage as compared to

later stage. Rating of foliar damage at vegetative stage was ranged from 1 to 3 score. Five treatments as Chloropyriphos 50EC+Cypermethrin 5EC@1ml/lit of water (1 score), Spinosad 45% EC (1.6 score), Furadon 3 G (1.6 score) and Darshan (Chlorophyriphos 20EC (1.6 score) performed at par to each others. Percent damage of plants at younger stage (knee high stage) was more (Range 6.9-17.9%) as compared to tasseling stage (Range 2.9-16.6%). Mean of two observations, revealed that was better Chloropyriphos 50EC+Cypermethrin5EC (5.3%) followed by Spinosad 45% EC (6.6%) and Furadon 3 G (7.6%) but in case of tunnel length and exit holes, Fipronil showed the low infestation as compare to other treatments. Trend of tunnel length measurement in each treatment were at par and more or less resemble to exit holes. Concerning the grain yield, Chloropyriphos 50EC+Cypermethrin 5EC recorded the highest yield (8.7 t/ha) followed by Darshan (Chloropyriphos 20EC) (8.5 t/ha) and rest treatments were more or less same except control. In conclusion, Chloropyriphos 50EC+Cypermethrin 5EC@1ml/lit of water, Spinosad 45% EC@ 0.5ml/lit of water, Furadon 3 G@3-4gm/whorl and Darshan (Chlorophyriphos 20EC @ 1.5ml/lit of water were performed better in maize stem borer management as compared to other tested pesticides (Table 98).

2.5.2.3 Management of maize storage pest through the use of indigenous botanical plant's parts

Materials and Method

An experiment composed of 7 treatments including control was evaluated against storage insect pests at NMRP, during 2071/72. Different kind of indigenous botanical plant parts; Bojho (*Acorus calamus*) root powder @10 g/ Kg of grains, Neem (*Azadiracta indica*) seed powder @10 g/ Kg of grains, Mug-wort (*Artemisia vulgaris*) leaf @10 g/ Kg of grains, Timur (*Zanthoxylum alatum*) @3-4 g/kg seed, Chinaberry (*Melia azedarach*) dust @10g/kg seed, Malabar nut tree (*Justicia adhatoda*) leaf @ 10 g/kg seed were used for the experiment. The experiment was laid in CRD design with three replications. Manakamana-3 (white released variety) was used for the purpose. Sampling was done at the rate of 100 gm of seeds every two month and analyzed for moisture percentage, number of insects particularly *Sitophyllus zeamais* and *Sitotroga cerealella* per 100 gm of seeds and germination percent in seed laboratory at NMRP/IAAS, Rampur.

Results

Up to 4 month experiment, Bojho (*Acorus calamus*) rhyzome dust @10 g/kg seed and Neem (*Azadiracta indica*) seed kernel powder @10 g/kg seed showed good result against weevil and month in storage condition at Rampur (Table 99).

Table 97. Response of maize genotype to maize stem borer, *C. partellus.*

SN	Genotpyes	Score (0-9)scale		Mean	% damage		Mean	Tunnel length	Exit holes
		Knee high stage	Before tasseling stage		Knee high stage	Before tasseling stage			
1	Across 9331	4.0	2.6	3.3	51.2	21.6	36.4	7.1	2.7
2	Across 9942 × Across 9944	3.0	2.3	2.6	35.1	14.7	24.9	11.5	2.5
3	Arun-1 EV	3.0	2.0	2.5	30.8	15.2	23.0	18.7	4.1
4	Arun-4	3.6	3.3	3.5	43.7	22.6	33.2	7.3	2.2
5	BGBYPOP	2.6	1.6	2.1	29.9	16.4	20.1	4.3	1.6
6	COTA×LA 0024	2.3	3.0	2.6	20.2	15.7	18.0	7.2	2.4
7	HG-B	3.0	2.6	2.8	23.6	21.4	22.5	8.0	3.1
8	Khumal yellow x Pool 17	3.3	2.6	3.0	30.0	19.2	24.6	7.6	2.5
9	OEHPW	3.0	2.0	2.5	26.8	10.6	18.7	11.1	3.2
10	Rampur SO3FO2	3.6	2.6	3.1	32.8	28.8	30.8	8.1	3.8
11	RampurSO3F8	5.0	2.3	3.6	32.8	19.6	26.2	9.7	2.6
12	RampurSO3FQ02	2.6	2.0	2.3	32.5	14.4	23.5	9.1	3.8
13	Rampur S10F18	2.3	2.3	2.5	25.5	10.7	18.1	11.5	3.7
14	Rampur S10F20	3.0	2.3	2.6	32.5	20.6	26.5	9.1	3.4
15	Rampur S10F22	2.6	2.3	2.5	20.2	15.0	17.6	9.6	1.4
16	Rampur SO3FO4	3.3	1.6	2.5	31.3	9.7	20.5	5.7	2.1
17	R-POP-1	3.3	2.3	2.8	35.7	19.0	27.3	11.6	3.2
18	R-POP-2	4.0	3.6	3.8	41.5	22.2	31.8	7.1	2.2
19	Upahar	2.6	2.6	2.6	24.8	15.8	20.3	13.2	3.0
20	S99TLYQ-AB	3.6	3.0	3.3	29.3	33.4	31.3	14.0	3.7
21	S99TLYQ-B	3.0	1.6	2.3	26.9	15.8	21.3	9.1	1.3
22	S03TLYQ-AB-01	3.3	3.6	3.5	32.0	31.6	31.6	9.5	3.3

SN	Genotpyes	Score (0-9)scale		Mean	% damage		Mean	Tunnel length	Exit holes
		Knee high stage	Before tasseling stage		Knee high stage	Before tasseling stage			
23	S03TLYQ-AB-02	4.0	3.6	3.8	34.9	32.9	33.9	13.9	4.1
24	S01SIWQ-1	3.6	1.3	2.5	33.1	15.6	24.3	11.4	4.0
25	S01SIWQ-3	4.6	3.0	2.6	16.4	21.0	18.7	7.8	2.4
26	S00TLYQ-AB	3.6	3.0	3.3	37.9	25.4	31.6	4.3	1.8
27	S00TLYQ-B	3.0	1.3	2.1	33.5	12.0	22.8	5.9	1.9
28	RML-32 × RML-17	2.3	1.6	2.0	25.0	7.8	16.4	10.6	3.1
29	RML-4 × RML-17	2.6	3.0	2.8	21.4	27.1	24.2	9.6	2.7
30	RML-95 × RML-96	2.3	2.0	2.1	21.9	5.3	13.6	6.9	1.6
31	RML-87 × RL-105	1.6	2.0	1.8	16.2	8.7	12.4	4.7	1.4
32	RML-57 × RML-6	3.0	2.6	2.8	24.7	16.9	20.8	8.1	2.0
33	KYM-33 × KYM-35	3.6	3.0	3.3	32.1	18.6	25.4	6.9	2.1
34	RL-180 × RL-105	3.3	2.3	2.8	29.1	12.6	20.9	7.0	1.8
35	RL150 × RL-111	2.6	1.6	2.1	23.5	7.9	15.7	11.6	3.0
36	RML-86 × RML-96	2.3	1.6	2.0	21.3	7.2	14.2	6.7	2.2
37	Arun-2	4.3	3.6	4.0	43.3	28.3	35.8	24.0	5.4
38	Poshilo makai-1	2.6	2.0	2.3	34.1	14.2	24.2	9.1	1.9
39	Rampur Composite	2.6	2.3	2.5	36.5	20.2	28.3	10.7	3.8
40	Rampur hybrid-2	3.6	2.0	2.8	37.0	15.0	26.0	7.4	1.9
	Grand Mean	**3.2**	**2.4**	**2.7**	**30.3**	**17.6**	**23.9**	**9.4**	**2.7**
	F-test	NS	*	*	NS	Ns	*	*	Ns
	CV%	60.4	34.1	29.4	35.7	55.7	34.9	40.7	59.6
	$LSD_{0.05}$	-	1.345	1.328	-	-	13.623	9.322	-

Table 98. Response of pesticides to maize stem borer management

SN	Treatment	Score (0-9) scale		Sore mean	Percent damage		Damage mean	Tunnel length (cm)	Exit holes (No)	Yield (kg/ha)
		Knee high stage	Before tasseling stage		Knee high stage	Before tasseling stage				
1	Fipronil 0.3g@3-4 gm/whorl	2.3	1.6	2.0	16.8	5.3	11.0	3.0	0.9	8.3
2	Spinosad 45% EC@0.5ml/ lit of water	2.0	1.3	1.6	10.5	2.9	6.6	5.0	1.1	8.2
3	Furadon 3 G@3-4gm/whorl	2.0	1.3	1.6	11.2	4.0	7.6	10.7	2.6	8.1
4	Margosom @3ml/lit of water	3.0	1.6	2.3	16.6	6.1	11.3	11.1	3.7	8.2
5	Chloropyriphos 50EC+Cypermethrin 5EC@1ml/lit of water	1.0	1.0	1.0	6.9	3.7	5.3	4.9	1.1	8.7
6	Darshan (Chlorophyriphos 20EC)@1.5ml/lit of water	2.3	1.0	1.6	13.3	4.4	8.8	10.2	3.8	8.5
7	Confider 200SL (Imidachloprid 17.8%) @0.5ml/lit of water	2.0	2.0	2.0	15.2	6.7	10.8	11.8	3.4	8.2
8	Control	2.3	4.6	3.5	17.9	16.6	17.2	9.6	2.3	7.5
	Grand mean	2.1	1.8	1.9	13.5	6.2	9.8	8.3	2.4	8.2
	F-test	*	*	**	*	*	*	Ns	*	*
	CV%	24.4	30.1	19.5	38.7	34.4	30.2	57.7	59.2	4.5
	$LSD_{0.05}$	0.906	0.961	0.675	9.174	3.742	5.223	-	2.492	0.649

Table 99. Response of botanicals against maize storage pests management

S. N.	Treatment	Damage % at Ist observation	Damage % at Ist observation	Mean damage %	Moisture % at Ist observation	Moisture % at Ist observation	Mean moisture %
1	Bojho (*Acorus calamus*) root powder @10 g/ Kg of grains	1.3	1.7	1.2	15.9	16.6	15.3
2	Neem (*Azadiracta indica*) seed powder @10 g/ Kg of grains	2.2	3.4	2.0	16.0	16.7	15.4
3	Mug-wort (*Artemisia vulgaris*) leaf @10 g/ Kg of grains	2.1	3.9	3.0	16.0	16.7	15.4
4	Timur (*Zanthoxylum alatum*) @3-4 g/kg seed	2.7	6.0	4.4	16.0	16.7	15.4
5	Chinaberry (*Melia azedarach*) dust @10g/kg seed	1.7	4.1	2.9	16.1	16.8	15.4
6	Malabar nut tree (*Justicia adhatoda*) leaf @ 10 g/kg seed	1.8	2.8	2.3	15.6	15.8	15.3
7	Control	3.8	6.8	5.3	15.9	16.2	15.6
	Grand mean	2.2	4.0	3.1	15.9	16.5	15.4
	F-test	Ns	*	*	*	*	Ns
	CV%	55.3	37.5	17.1	1.5	2.3	1.4
	$LSD_{0.05}$	-	2.701	0.963	0.434	0.676	-

2.5.2.4 Evaluation of effect of packing materials and seed moisture content on storability of maize (Zea mays L.) seeds

Materials and Method

Shelled grains of maize variety Mankamana-3 stored in different storage structures in different moisture level at NMRP, Rampur (228 m asl) for six month from January to June, 2015. Maize seeds were sun dried/oven dried to 15%, and 12% moisture content. Initial standard germination and moisture content were tested in all seed lots before starting the experiment. A laboratory experiment was set up to investigate the efficacy of various storage methods of maize grains using different containers (Super grain bag/ IRRI super bag, Pordue Improved Crop Storage (PICS), 200 guage plastic bag, 400 guage plastic bag, metal bin, normal jute bag, and normal plastic bag). Five kg maize seeds stored in each storage structure. Treatments were arranged in a factorial experiment with two moisture level and seven storage structures. Sampling was done at the rate of 100 gm of seeds every two month and analyzed for moisture percentage, number of insects particularly *Sitophyllus zeamais* and *Sitotroga cerealella* per 100 gm of seeds and germination percent in seed laboratory at NMRP/IAAS, Rampur.

Results

The result revealed that all treatments showed significant result upto 4 month experiment. Among the treatments, super grain bag, Polythine bag (200 gauge) and PICS (Purdue Improved Crop Storage) bag found least damage by storage insect pests as compare to others in both cases (12% and 15% moisture level) (Table 100 & 101).

Table 100. Response of storability of packing materials and seed moisture level (12%) against maize storage pests

S.N.	Treatment	Damage % at Ist observation	Damage % at 2nd observation	Mean damage %	Moisture% at Ist observation	Moisture% at 2nd observation	Mean moisture %
1	Super grain bag (developed by IRRI)	2.3	0.5	1.4	13.8	14.0	13.9
2	Purdue Improved Crop Storage (PICS) bag	1.5	0.1	0.8	14.4	14.7	14.5
3	Polythine bag having 200 gauge size	0.6	1.1	0.9	15.7	14.5	15.1
4	Polythine bag having 400 gauge size	2.6	1.0	1.8	12.6	14.5	13.5
5	Metal bin (20 kg capacity bin made by galvanized flat iron sheets)	1.2	2.7	2.0	15.6	15.0	15.3
6	Control (Normal polythene bag, being practiced by farmers)	4.8	5.1	5.0	14.4	16.1	15.3
	Grand mean	2.3	1.8	2.0	14.4	14.8	14.6
	F-test	*	*	*	**	**	**
	CV%	43.9	40.3	44.1	3.1	1.8	2.2
	$LSD_{0.05}$	1.783	-	-	0.805	0.484	0.587

Table 101. Response of storability of packing materials and seed moisture level (15%) against maize storage pests

S.N.	Treatment	Damage % at Ist observation	Damage % at 2nd observation	Mean damage %	Moisture% at Ist observation	Moisture% at 2nd observation	Mean moisture %
1	Super grain bag (developed by IRRI)	0.8	0.1	0.4	15.2	16.1	15.6
2	Purdue Improved Crop Storage (PICS) bag	1.2	1.3	1.2	15.0	15.9	15.4
3	Polythine bag having 200 gauge size	1.6	0.2	0.9	14.7	16.3	15.5
4	Polythine bag having 400 gauge size	1.7	1.5	1.6	14.9	16.3	15.8
5	Metal bin (20 kg capacity bin made by galvanized flat iron sheets)	1.2	5.4	3.3	15.7	16.3	16.0
6	Control (Normal polythene bag, being practiced by farmers)	2.6	20.8	11.7	15.9	17.0	16.4
	Grand mean	1.5	4.9	3.2	15.2	16.3	15.8
	F-test	*	**	**	*	*	**
	CV%	30.0	45.6	43.6	1.0	2.2	1.4
	$LSD_{0.05}$	0.857	5.150	2.570	0.281	0.611	0.364

2.6 Outreach Research

2.6.1 Participatory evaluation of hybrid and open pollinated maize genotype in command districts of NMRP, Rampur, Chitwan, Nepal

Materials and Method

The experiments were designed by researchers and managed by farmers. All the experiments were laid out in a RCB design with 3 replications (farmer as replicates). Each trial includes farmer's cultivars to compare the performance of testfed varieties. The seed rate was 20 kg/ha, 75 cm row to row and 25 cm plant to plant spacing and 22.5 m2 plot size were maintained in each experiment. FYM @ 10 t/ha and Fertilizer 180:60:40 kg NPK/ha was applied for hybrid, 120:60:40 kg NPK/ha for full season genotype and 80:60:40 kg NPK/ha for early maturing genotype. Half dose of nitrogen and full dose of phosphorous and potash was applied as basal dose at the time of final land preparation and remaining half of nitrogen was splitted into two; first part applied at 20-24 and second part 40-45 days after sowing. Weeding and irrigation was done as farmers per recommendation. Other details of the experiments are shown in Table 102.

Table 102. Detail of experiments carried out at outreach sites during 2071/72

S.N.	Experiment	Testing Site	Genotype
1	CFFT-Hybrid	Jayamangala and Madi (Chitwan)	8 genotype, RCBD, 22.5 m^2 plot area
2	CFFT-QPM	Madi (Chitwan), Rajahar (Nawalparasi)	6 genotype, RCBD, 22.5 m^2 plot area
3	CFFT-F. S. (terai set)	Madi (Chitwan)	7 genotype, RCBD, 22.5 m^2 plot area
4	CFFT-F.S. (Hill set)	Suping (Makawanpur)	5 genotype, RCBD, 22.5 m^2 plot area
5	CFFT Early set	Madi (Chitwan)	6 genotype, RCBD, 22.5 m^2 plot area

Results

2.6.1.1 Maize CFFT Hybrid set

Eight hybrid maize genotype were evaluated including multinational company hybrid (Decalb double) as a check at Madi and Jayamangala, Chitwan during 2071/72. Analysis showed non significant difference in grain yield at Madi but significant difference result was found at Jayamangala, Chitwan. Among the tested genotype, company hybird showed little bit higher yield in both areas than our NMRP hybrid genotype (Table 103)

Table 103. CFFT Hybrid trial at Madi and Jayamangala, Chitwan 2071/72 winter

S. N.	Genotype	Madi, Chitwan			Jayamangala, Chitwan		
		P H (cm)	EH (cm)	Yield (kg/ha)	PH (cm)	EH (cm)	Yield (kg/ha)
1	RML-95/RML-96	195.5	106.8	8.4	180.3	89.7	9.3
2	RML-86/RML-96	199.8	105.0	8.3	174.4	83.7	10.4
3	(RML-95/RML-96)/RML-17	172.8	86.5	9.4	160.7	77.0	9.7
4	(RML-86/RML-96)/RML-17	176.2	89.5	9.3	156.0	74.3	8.8
5	RML-4/RML-17	182.0	92.2	8.1	157.7	74.3	8.8
6	RML-32/RML-17	186.2	92.5	7.2	169.3	78.3	8.4
7	Rampur Hybrid-2	180.5	91.2	8.9	163.0	77.0	10.3
8	Decalb double	182.5	93.2	9.5	161.3	76.0	11.1
	G.M.	184.4	96.6	8.6	165.4	78.8	9.6
	F-Test	*	*	NS	**	NS	*
	CV %	5.6	7.2	17.3	3.3	8.9	6.4
	$LSD_{0.05}$	15.16	10.06	-	9.45	-	1.084

2.6.1.2 CFFT Hybrid combined analysis

In mean comparison, company hybrid (Decalb double) showed highest yield (10.2 t/ha) followed by Rampur Hybrid-2 (9.5 t/ha) and (RML-95/RML-96)/ RML-17 (9.5 t/ha) respectively (Table 104).

Table 104. Combined result of CFFT Hybrid during 2071/72 winter

S.N.	Genotype	Plant height (cm)	Ear height (cm)	Yield (kg/ha)
1	RML-95/RML-96	189.0	99.4	8.8
2	RML-86/RML-96	189.0	95.8	9.2
3	(RML-95/RML-96)/RML-17	167.6	82.4	9.5
4	(RML-86/RML-96)/RML-17	167.6	83.0	9.0
5	RML-4/RML-17	171.6	84.5	8.4
6	RML-32/RML-17	179.0	86.4	7.7
7	Rampur Hybrid-2	173.0	85.1	9.5
8	Decalb double	173.4	85.8	10.2
	G.M.	176.3	87.8	9.0
	F-Test	**	**	*
	CV %	4.7	7.5	13.2
	$LSD_{0.05}$	8.94	7.078	1.290

2.6.1.3 Maize CFFT QPM set

The experiment on quality protein maize (QPM) was conducted in on-farm at Madi and Jayamangala OR sites. Statistically non significant difference result was found in plant height and ear height but significant in grain yield. Among the tested genotype, S99TLYQ-B showed the highest result (6.47 t/ha) followed by SO3TLYQ-AB-02 (6.03 t/ha) and released variety posilo makai-1 (5.85 t/ha) respectively (Table 105).

Table 105. CFFT QPM trial at Madi and Jayamangala, Chitwan 2071/72 summer

S.N.	Genotype	Plant height (cm)	Ear height (cm)	Yield (kg/ha)
1	S99TLYQ-A	176.5	76.0	4.65
2	SO3TLYQ-AB-01	163.0	72.5	5.67
3	S99TLYQ-B	158.5	72.5	6.47
4	SO3TLYQ-AB-02	156.0	65.0	6.03
5	F.V.	161.5	77.5	4.12
6	PM-1	170.0	65.0	5.85
	G.M.	164.2	71.4	5.45
	F-Test	NS	NS	*
	CV %	8.2	15.8	6.8
	$LSD_{0.05}$	34.44	28.19	6.951

2.6.1.4 Maize CFFT Full season Terai set

In grain yield, the tested genotype were found significant difference but non significant difference was found in plant height and ear height. Upahar produced the height yield (6.4 t/ha) followed by HG-A (5.8 t/ha) and Across-9331 (5.1 t/ha) respectively (Table 106).

Table 106. The result of CFFT Full season maize (terai set) during 2071/72

S.N.	Genotype	Plant height (cm)	Ear height (cm)	Yield (kg/ha)
1	Upahar	192.2	96.2	6.4
2	Across-9331	187.5	93.2	5.1
3	HG-A	190.5	91.0	5.8
4	HG-B	185.5	95.8	4.3
5	FV	197.0	99.5	5.0
	G.M.	190.6	95.2	5.3
	F-Test	NS	NS	*
	CV %	4.7	6.6	14.8
	$LSD_{0.05}$	13.72	9.63	1.212

2.6.1.5 Maize CFFT Early set

Six early maize genotype were tested at madi, Chitwan during 2071/72. Statistically non significant results were recorded for all parameters. However, farmers variety produced the highest yield (6.1 t/ha) followed by EEYC-1 (5.0 t/ha) and Pool-16 E (4.5 t/ha) respectively presenting at table 107.

Table 107. Grain yield of early maize genotype during 2071/72 summer

S.N.	Genotype	Plant height (cm)	Ear height (cm)	Yield (kg/ha)
1	Pop-445/pop-446	156.0	75.0	4.0
2	Zm-621/pool-15	175.0	89.0	3.8
3	EEYC-1	176.0	86.0	5.0
4	Pool-16 E	172.0	75.0	4.5
5	Arun-2	182.0	86.5	3.3
6	F.V.	188.0	90.0	6.1
	G.M.	174.8	84.2	4.5
	F-Test	NS	NS	NS
	CV %	7.4	10.8	21.3
	$LSD_{0.05}$	-	-	-

2.6.1.6 Maize CFFT Full season Hill set

The result revealed that the genotype, Across-9331 produced the highest yield (5.74 t/ha) followed by Upahar (4.51 t/ha) and HG-B (5.18 t/ha) respectively (Table 108).

Table 108. Grain yield and other traits of CFFT Full season maize genotype, Makawanpur during 2071/72 summer

S.N.	Genotype	Plant height (cm)	Ear height (cm)	Yield (kg/ha)
1	Upahar	160	78.4	4.51
2	Across-9331	176	88.7	5.74
3	HG-A	170	77.7	4.48
4	HG-B	174	83.3	4.50
5	F.V.	179	87.7	3.76
	G.M.	171.8	83.1	4.59
	F-Test	NS	NS	NS
	CV %	6.1	10.9	14.0
	$LSD_{0.05}$	-	-	-

Conclusion

The yields of promising pipeline maize genotype were higher than famers' varieties. We concluded that the company hybrid (Decalb double) showed little bit higher yield (10.2 t/ha) than released variety Rampur Hybrid-2 (9.5 t/ha) and three way cross hybrid genotype (RML-95/RML-96)/RML-17 (9.5 t/ha). Similarly, in QPM genotype; S99TLYQ-B, SO3TLYQ-AB-02, full season genotype; Upahar, HG-A and Across-9331 and early genotype; EEYC-1 and Pool-16 E were identified as promising and preferred by farmers.

2.6.2 Participatory evaluation of Rice and Wheat genotype in command district of NMRP, Rampur, Chitwan, Nepal

Materials and Method

Coordinated Farmers Field Trial-Rainfed Lowland Early (CFFT-RLE), Coordinated Farmers Field Trial-Normal (CFFT-N), Coordinated Farmers Field Trial-Fine and Aromatic Rice (CFFT-FAR), and Farmers Acceptance Trial (FAT) were conducted at Outreach (OR) sites of National Maize Research Program (NMRP) viz. Madi village of Chitwan, Rajahar village Development Committee (VDC) of Nawalparasi and Manahari village of Makawanpur in the summer season of 2071/72. New rice genotype for verification trials were received from National Rice Research Program (NRRP), Hardinath and wheat genotype from National Wheat Research Program (NWRP), Bhairahawa. The experiment was designed by the researcher and managed by the corresponding farmer but the multidisciplinary team of researcher provided feedback to the farmers by seasonal observation; joint monitoring and data recording. The summary of materials and methods while conducting Rice and Wheat experiments (Table 109).

Table 109. Detail of experiments carried out at outreach sites during 2071/72

S.N.	Experiment	Testing Site	Genotype
1	CFFT-Normal-Rice	Jayamangala and Madi (Chitwan), Manahari (Makawanpur), Rajahar (Nawalparasi)	6 genotype, RCBD, 22.5 m^2 plot area
2	CFFT-Early Rice	Madi (Chitwan), Rajahar (Nawalparasi)	7 genotype, RCBD, 22.5 m^2 plot area
3	CFFT-Fine and Aromatic Rice	Madi and Jayamangala (Chitwan), Rajahar (Nawalparasi)	7 genotype, RCBD, 22.5 m^2 plot area
4	CFFT-Normal-Wheat	Jayamangala, Madi and Shivanagar (Chitwan), Rajahar (Nawalparasi)	7 genotype, RCBD, 22.5 m^2 plot area

Results and Discussion

2.6.2.1 CFFT Normal set Rice

This experiment was conducted at NMRP OR sites including 6 different genotype. Statistically, non-significant result was found in yield however, released variety Sabitri showed the highest yield (4.83 t/ha) followed by IR-87615-9-3-1-3 (4.74 t/ha) and IR-81826-B-B-5-7 (4.43 t/ha) respectively and preferred by farmer in same way. Details are shown in table 110.

Table 110. Result of grain yield of CFFT normal set Rice during 2071/72 summer

S.N.	Genotype	Plant height (cm)	Grain yield (t/ha)
1	IR-87615-9-3-1-3	105.0	4.74
2	IR-77721-93	108.0	4.36
3	IR-81826-B-B-5-7	128.0	4.43
4	HUA-565	93.0	4.23
5	Sabitri	103.3	4.82
6	F.V.	104.7	4.43
	G.M.	107.0	4.50
	F-test	*	NS
	CV%	10.1	9.3
	$LSD_{0.05}$	19.75	-

2.6.2.2 CFFT Early Rice

Among the tested early genotype, non significant result was found in grain yield. However, farmer variety showed the highest yield (4.78 t/ha) followed by IR-64683-87-2-2-3-3 (4.76 t/ha) and Hardinath-1 (4.75 t/ha) respectively (table 111).

Table 111. Result of grain yield of CFFT Early set Rice at NMRP command districts during 2071/72

S.N.	Genotype	Plant height (cm)	Grain yield (t/ha)
1	IR-64683-87-2-2-3-3	92.0	4.76
2	IR-81063-B-94-U-3-3	92.0	3.69
3	IR-83377-B-B-47-2	102.0	4.71
4	IR-83388-B-B-108-3	89.5	3.42
5	Hardinath-1	83.0	4.75
6	Radha-4	76.0	3.44
7	F.V.	89.0	4.78
	G.M.	89.0	4.22
	F-test	*	NS
	CV%	10.25	34.8
	$LSD_{0.05}$	9.15	-

2.6.2.3 CFFT Fine and Aromatic Rice

Statistically, yield showed non significant result however, IR-77542-90-1-1-1-1-5 produced the highest yield (4.06 t/ha) followed by IR-77539-80-2-2-2 (3.95 t/ha) and farmer's variety (3.89 t/ha) respectively. Details are shown in table 112.

Table 112. Results of grain yield of CFFT-FAR (Fine & Aromatic Rice) during 2071/72 at NMRP-OR sites

S.N.	Genotype	Plant height (cm)	Grain yield (t/ha)
1	IR-77542-90-1-1-1-1-5	84.0	4.06
2	IR-78545-57-9-1-1-3	86.0	3.50
3	IR-77539-80-2-2-2	93.7	3.95
4	IR-78539-32-1-2-1	80.3	3.85
5	IR-77512-128-2-1-2	74.3	3.75
6	Samba masuli Sub-1	71.0	3.67
7	F.V.	86.7	3.89
	G.M.	82.3	3.81
	F.TEST	*	NS
	C.V.%	9.4	18.9
	LSD	13.81	-

2.6.2.4 CFFT Wheat

This trial was conducted at all the locations of OR sites of NMRP. Seven genotype including farmer’s variety were evaluated during year 2071/72. Among the tested genotype, the highest yield was produced by released variety BL-4316 (3.36 t/ha) followed by NL-1172 (3.12t/ha) and NL-1177 (3.06 t/ha) respectively (table 113).

Table 113. Combined results of grain yield and other traits of CFFT normal Wheat during 2071/72 at NMRP command districts

S.N.	Genotype	Grain yield (kg/ha)			
		Jayamanagala (Chitwan)	Madi (Chitwan)	Keureni (Nawalparasi)	Combined
1	BL-4316	3.59	3.67	2.81	3.36
2	BL-4347	2.35	3.58	2.28	2.73
3	NL-1172	3.3	3.33	2.72	3.12
4	NL-1177	3.28	3.16	2.74	3.06
5	BL-4341	2.46	3.75	2.15	2.78
6	Vijay	2.93	3.58	2.6	3.03
7	F.V.	2.11	2.81	2.42	2.45
	GM	2.86	3.41	2.53	2.93
	F.test	*	*	NS	*
	CV	16.6	8.4	17.4	8.1
	LSD	0.846	0.510	-	0.424

Conclusion

The yield of improved Rice and Wheat varieties were higher than farmer's varieties except Sabitri in Rice and Vijaya in Wheat. In rice genotype, IR-87615-9-3-1-3 and IR-81826-B-B-5-7 for normal season, IR-64683-87-2-2-3-3 for early season and IR-77542-90-1-1-1-1-5 and IR-77539-80-2-2-2 for fine and aromatic purposes showed the best performance. Similarly, in wheat genotype BL-4316 and NL-1172 showed the best performance in terms of both yield and farmer's ranking.

2.7 Multilocation experiments

Different experiments on rice and wheat were conducted during 2071/072 summer and winter season at Rampur. The experiments conducted were disease screening nursery on rice and wheat and three coordinated yield trials on rice namely; CVT-normal, CVT-fine and aromatic and CVT-rainfed low land early and all these sets were received from NRRP, Hardinath. In wheat IET, CVT, WVD and NRN sets were received from NWRP, Bhairahawa. The summary of findings has been presented in this report.

2.7.1 Rice

Four experiments were received during 2071/72 and were planted at Agronomy farm of NMRP, Rampur. A total of 30 genotype were included in CVT-Normal set and out of tested genotype NR-2158-13-1-2-4-1 (5.1 t/ha) produced the highest grain yield followed by MTU-115 and NR-2157-144-1-3-1-1-1 (4.7 t/ha). The details of other agronomic traits have been presented in Table-114. In another set CVT-fine and aromatic set, 16 rice genotype were evaluated and the highest yield was obtained from IR-9478-67-3-3-2 (5.0 t/ha) followed by IET-17278, IR-78006-55-2-3-3 and IR-83377-B-B-105-4 (4.4 t/ha), respectively (Table-115). Similarly, in CVT-rainfed low land and early set, 26 rice genotype were included and for grain yield production four genotype namely; Radha-4, IR-48859-B-86-3-1, IR-80408-B-43-3 and IR-87754-42-2-2 produced more than 4 t/ha grain, respectively. Other details of agrononomic traits have been presented in Table-116. For disease point of view, Rampur is hot spot for rice blast and every year one set of national rice blast nursery (NRBN) is being received from NRRP, Hardinath. During 2014/15 summer season one set of NRBN containing 330 rice genotype were screened at Rampur. Out of the tested genotype 46 genotype were free from blast disease with the score of 'O' and 102 genotype showed highly resistant against this disease with final score of '1' (0-9 score) and details of disease scoring has been presented in Table-117.

Table 114. Coordinated varietal trial (CVT-N) on normal rice 2071/72 at Rampur, Chitwan

S.N.	Genotype	50% flowering	Panicle leng (cm)	Plant ht. (cm)	Tiller/ M2	Maturity days	GY t/ha
1	IR70215-39-CPA	76	26	130	281	115	3.6
2	IR73718-26-1-2-5	89	24	114	270	125	4.0
3	HUANZHUAZHA	79	22	102	248	119	3.3
4	NR2157-166-1-3-5-1	103	22	108	226	134	4.0
5	NR2157-63-2-2-1-1	92	24	114	255	134	3.8
6	NR2157-166-2-1-1-1	98	22	106	257	138	4.1
7	NR2158-13-1-2-4-1	95	23	108	285	128	5.1

S.N.	Genotype	50% flowering	Panicle leng (cm)	Plant ht. (cm)	Tiller/ M2	Maturity days	GY t/ha
8	8NR2167-41-11-3-1	93	24	124	282	126	3.7
9	CT19151-7-5-1-25R-1P	89	25	121	271	124	4.0
10	IR76939-98-1-1-1	97	27	124	260	135	4.6
11	YN2883-12-2-1	91	24	124	283	126	3.8
12	IR80285-3-3-3-2	87	26	104	268	119	3.8
13	NR2157-198-1-3-2-1	95	21	96	288	139	2.1
14	NR2167-46-1-1-1-1	93	24	125	249	130	3.8
15	HWA 564	87	25	122	185	133	3.5
16	NR2157-54-1-1-1-1	103	23	112	290	136	4.6
17	NR2157-32-2-2-2-1	103	23	130	239	137	3.5
18	NR2157-144-1-3-1-1-1	95	23	104	230	131	4.7
19	IR78875-207-B-B-B	85	26	118	271	118	4.0
20	IR83372-B-B-33-2	88	24	120	221	119	2.9
21	NR2158-13-1-12-4	93	22	105	282	137	3.4
22	IR79525-20-2-2-2	88	25	114	258	125	3.7
23	CIEHRANG SUB1	81	25	116	217	118	3.4
24	CT18148-6-9-3-3-2-MMP	89	25	117	264	125	3.3
25	IR87377-B-B-93-3	81	25	120	197	121	3.1
26	IR70210-39-CPA-7-1	79	26	137	245	127	3.3
27	IR79584-38-2-1-4	90	25	117	272	121	3.6
28	MTU 115	103	25	106	202	140	4.7
29	IR 11F 267	89	25	108	302	123	3.7
30	SABITRI	97	26	112	273	132	4.2
	Mean	91	24.2	115	256	128	3.8
	F-test	**	**	**	**	**	**
	CV%	4.6	6.2	5.2	11.7	5.1	13.8
	$LSD_{0.05}$	6.9	2.5	11.2	48.9	10.7	0.85

Table 115. Coordinated varietal trial (CVT-FAR) on Fine and aromatic rice 2071/72 at Rampur, Chitwan

S.N.	Genotype	50% flowering	Plant ht. (cm)	Panicle leng (cm)	Maturity days	Tiller/ M2	Gy t/ha
1	TOX322-6-5-2-2-2-2	91	112	22	125	260	4.3
2	IET 17278	92	108	25	126	293	4.4
3	IR78006-55-2-3-3	89	114	26	124	301	4.4
4	IR77512-2-1-2-2	86	109	25	121	199	3.9
5	IR78554-145-1-3-2	86	109	26	120	284	4.2
6	IR71146-97-1-2-1-3	82	108	24	115	215	3.3
7	IR77537-24-1-3	85	110	25	125	253	3.6
8	I79478-67-3-3-2	86	113	26	122	232	5.0
9	IR78555-68-3-3-3	85	111	23	122	247	4.0
10	CT9882-16-4-2	86	111	25	124	256	4.1
11	IR83377-B-B-123-2	86	121	24	127	261	4.1
12	IR87749-10-1-1-4	83	116	27	117	238	4.0
13	IR83377-B-B-105-4	86	113	23	118	262	4.4
14	IR83373-B-B-24	82	109	23	124	252	4.0
15	IR83373-B-B-25-3	85	115	27	119	234	4.0
16	Sambha Mahasuri sub-1(check)	101	94	19	125	293	3.6
	Mean	87	111	24.4	12.2	255	4.1
	F-test	**	ns	**	ns	**	ns
	CV%	1.1	7.2	6.4	5.2	11.4	13.1
	$LSD_{0.05}$	1.6	13.3	2.6	10.7	48.5	0.89

Table 116. Coordinated varietal trial (CVT-RLE) on rain-fed low land early rice 2071/72 at Rampur, Chitwan

S.N.	Genotype	50% flowering	Panicle leng (cm)	Plant ht. (cm)	Tiller/ M2	Maturity days	Gy t/ha
1	IR83754-B-B-40-2	82	23	111	207	115	3.4
2	IR-87761-28-1-1-3	85	24	110	198	116	3.1
3	IR-83381-B-B-117-4	84	27	112	220	116	3.4
4	IR-83380-B-B-124-2	85	23	98	226	116	3.1
5	08FAN6	82	24	127	203	114	3.2
6	BP1356-1G-KN-4	84	23	99	192	115	3.3
7	IR-09F4-36	86	23	109	258	116	3.7
8	IR-82635-B-B-58-1	81	24	117	204	114	3.7
9	IR-82635-B-B-25-4	84	24	117	211	115	3.7
10	IR75417-R-R-R-26	84	23	118	214	115	2.9
11	IR70210-39-CPA-7-1	83	26	114	207	114	3.9
12	IR80408-B-43-3	83	26	114	227	116	4.1
13	IR82870-48	81	26	115	219	112	3.5
14	IR79906-129-2-3	83	25	108	228	115	3.3
15	IR-87754-42-2-2	85	25	113	252	117	4.0
16	IR83750-B-B-13-1-1	82	26	112	224	114	3.2
17	IR88964-11-2-2-2	83	24	101	218	115	3.8
18	IR88966-45-2-1-3	89	23	104	245	115	3.6
19	IR48859-B-86-3-1	80	25	105	221	114	4.1
20	IR88869-2-1-1-4	84	21	103	207	115	3.4
21	IR88869-2-1-1-4	83	24	110	225	114	3.8
22	IR88965-19-3-1-2	83	24	105	240	115	3.6
23	IR88966-1-1-2-3	86	26	110	222	115	3.6
24	IR87875-207-B-B-B	84	25	109	234	115	2.9
25	HARDINATH-1	71	22	103	202	102	0.6
26	RADHA-4	86	25	111	235	117	4.2
	Mean	83	2.4	110	221	114	3.4
	F-test	**	ns	ns	ns	**	ns
	CV%	3.3	6.4	6.3	10.6	4.3	23.5
	$LSD_{0.05}$	5.7	3.1	14	48.3	1.8	1.7

Table 117. Response of rice genotype against rice blast disease 2071/72 at Rampur, Chitwan

S.N.	Genotype	Blast score (0-9)	Trt No.	Treatments	Blast score (0-9)
1	Sabitri	1	40	SC	9
2	Snkharika	4	41	IR82539-B-B-51-4	2
3	DR -11	1	42	IR 825589 -B-B-36=2	2
4	IR 72904-135-1	0	43	IR 82 589-B-B-95-2	1
5	BR 6474-220-1	0	44	IR 82635-B-B-47-1	0
6	NR 10491-13-1-3	0	45	IR 83750-B-30-3	0
7	IR 717-3-5-87-1-3	0	46	IR 82589-B-B-114-3	1
8	BR DHAN-38	0	47	IR 82589-B-B-149-4	3
9	PSBR 62	0	48	IR 82639-B-B-118-3	3
10	IR 76097-22-1-3-1	2	49	IR 82635-B-B-88-2	0
11	IR 78537-91-1	2	50	IR 82589-B-B-2-3	3
12	IR 72	1	51	IR 82589-B-B-142	5
13	JAYA	0	52	IR 79913-B-238-3-3	1
14	RADHA 4	1	53	IR 82 589-B-B-7-2	2
15	IR 78339-15-7-3-6	0	54	IR 55 419-04	1
16	1R 64683-87-2-2-3-3	0	55	IR 82589-B-B-84-3	3
17	IR 82635-B-B-1-2	1	56	IR 82589-B-B-13-3	2
18	IR 83399-B-B-52-1	1	57	IR 2589-B-B-121-3	2
19	Sabitri	1	58	IR 82635-B-B-82-2	1
20	SANKHARIKA	8	59	RC	0
21	IR 82635-B-B-27-2	1	60	SC	7
22	IR 82589-B-B-52-1	1	61	83749-B-B-55-1	1
23	IR 83377-B-B-47-3	3	62	TOX 322-6-5-2-2-2-2	3
24	IR87707-445-B-B-B	1	63	IET 17278	1
25	IR 83388-B-B-108-3	1	64	IR 78006-55-2-3-3	2
26	ADO 2029	1	65	IR77512-2-1-2-2	2
27	IR 77248-14-1-2-10	3	66	IR 78554-145-1-3-2	3
28	OM 5796	5	67	IR 71146-97-1-2-1-3	5
29	T0LERENT	3	68	IR 77537-24-1-3	2
30	O8 FAN 6	2	69	IR 79478=67-3-3-2	3
31	IR 81499-10-1-3-3-1	7	70	IR7855-68-3-3-3	1
32	IR 779538-1-1-1	7	71	CT 9892-16-4-2	2
33	OM 5629	1	72	IR 83377B-B-123-2	1
34	HARDINATH -1	1	73	IR 87749-10-1-1-4	2

S.N.	Genotype	Blast score (0-9)	Trt No.	Treatments	Blast score (0-9)
35	CHAITE-2	3	74	IR83377-B-B-105-4	0
36	IR 70181-32-PM1--1-1-4-2	1	75	IR83373-B-B-24	0
37	IR 83749-B-B-165-1	2	76	IR83373B-B-25-3	3
38	IR 83384-B-B-102-3	2	77	SAMBA MSULI SUB -1	2
39	RC	0	78	IR77542-90-1-1-1-1-5	3
79	RC	2	121	IR11F267	3
80	SC	9	122	IR70181-82-PMI-1-1-5-1	5
81	IR78545-57-2-1-1-3	3	123	C3419-10-1-2	3
82	IR77539-80-2-2-2	2	124	IR83377-B-B-93-3	5
83	IR78539-32-1-2-1	1	125	IR83376-B-B-47-3	1
84	IR77512-128-2-1-2	5	126	IR83873-B-B-47-3	1
85	IR 64683 87 2-2-3-3	3	127	IR 09L 171	7
86	IR 81063-B-94-4-3-3	5	128	IR 09L 179	7
87	IR 83377-B-B-47-2	5	129	IR 74371-70-1-1	5
88	IR 83388-B-B-108-3	1	130	IR 11L 319	3
89	NR 70215-39-CPA	1	131	IR 10L 398	3
90	IR73718-26-1-2-5	3	132	IR 10L 390	5
91	HUANGHUAZHA	5	133	IR 09L 182	3
92	NR2157-166-1-3-5-1	1	134	IR 09L 179	1
93	NR2157-63-2-2-1-1	0	135	IR 08L 152	1
94	NR2157-166-2-1-1-1	0	136	IR 10L 101	3
95	NR2158-13-1-2-4-1	0	137	IR 10L 234	7
96	NR2167-41-1-1-3-1	0	138	IR 09L 173	7
97	CT19151-7-5-1-25R-1P	0	139	RC	5
98	IR76939-98-1-1-1	1	140	SC	9
99	RC	1	141	IR 09L 166	3
100	SC	9	142	IR 08L 201	5
101	YN2883-12-2-1	5	143	IR 60080-46A	3
102	IR80285-34-3-3-2	3	144	IR 08L 220	3
103	NR2157-198-1-3-2-1	0	145	IR 10L 388	3
104	NR2167-46-1-1-1-1	1	146	IR 09L 348	3
105	HWA564	0	147	IR 11L 321	1
106	NR2157-54-1-1-1-1	0	148	Ghaiya-1(Check)	1
107	NR 2157-32-2-2-2-1	0	149	IR83754-B-B-40-2	1
108	NR2157-144-1-3-1-1-1	5	150	IR87761-28-1-1-3	3
109	IR78875-207-B-B-B	7	151	IR83381-B-B-117-4	7

S.N.	Genotype	Blast score (0-9)	Trt No.	Treatments	Blast score (0-9)
110	IR83372-B-B-33-2	5	152	IR83380-B-B-124-2	5
111	NR2158-13-1-12-4	3	153	08FAN6	5
112	IR70525-20-2-2-2	1	154	BP1356-1G-KN-4	7
113	CehrangSUB1	3	155	IR09F4-36	7
114	CT18148-6-9-3-3-2-MNP	1	156	IR82635-B-B-58-1	3
115	IR87377-B-B-93-3	7	157	IR82635-B-B-25-4	5
116	IR70210-39-CPA-7-1	7	158	IR75417-R-R-R-26	5
117	IR79584-38-2-1-4	3	159	RC	7
118	MTU115	1	160	SC	9
119	RC	3	161	IR70210-39-CPA-7-1	3
120	SC	9	162	IR80408-B-43-3	7
163	IR82870-48	3	206	IR04A395	3
164	IR79906-192-2-3	5	207	IR10F403	1
165	IR87754-42-2-2	3	208	IR06N155	3
166	IR83750-B-B-13-1-1	1	209	IR05N304	0
167	IR88964-11-2-2-2	1	210	IR09A133	3
168	IR88966-45-2-1-3	5	211	IRRI105	1
169	IR84859-B-86-3-1	7	212	IR04A115	1
170	IR88869-2-1-1-4	5	213	IR05N419	1
171	IR88869-2-1-1-4	7	214	ZHONGHUA-1	3
172	IR88965-19-3-1-2	7	215	IR06N234	3
173	IR88966-1-1-2-3	7	216	IR10F290	5
174	IR87875-207-B-B-B	5	217	IR10F203	7
175	HARDINATH-1	3	218	IR81896-B-B-68-B	1
176	RADHA-4	3	219	RC	3
177	NR2158-7-1-2-2-1-1	1	220	SC	9
178	NR2157-32-2-1-1-1-1	3	221	SABIRTI	1
179	RC	7	222	MAKWANPUR-1	3
180	SC	9	223	BP9474C-1-1-B	1
181	NR2157-66-2-3-1-1-1	1	224	IR83388-B-B-95-2	3
182	NR2157-122-1-2-1-1-1	3	225	IR833388-B-B-B-3	1
183	NR2160-68-1-1-1-1-1	3	226	IR83383-B-B-141-2	3
184	NR2167-48-5-1-2-1-1	1	227	WAS191-10-3-FKRI	1
185	NR2157-160-1-3-2-1	3	228	IR83376-B-B-130-2	3
186	IR76939-98-1-1-1	3	229	IR83376-B-B-130-3	5

S.N.	Genotype	Blast score (0-9)	Trt No.	Treatments	Blast score (0-9)
187	BP10620F-BB4-19-B-B-8	5	230	CT18148-6-9-3-3-2NP	7
188	NR2157-201-4-1-1	7	231	PR34467-3-1-1-2-1	1
189	TME 80518	5	232	IR83365-B-B-30-1	5
190	IR09N537	9	233	IR09F434	1
191	IR02A127	7	234	IR79615-9-3-1-3	3
192	IR08N150	5	235	Zx117	1
193	IR09N532	3	236	Ct16658-5-2-2SR-2-3-6NP	7
194	SAGC-02	5	237	Weed tolerant Rice	5
195	IR10A231	5	238	SACGA 4	1
196	HHZ12-DT10-SALI-DT1	5	239	RC	5
197	IR07A253	3	240	SC	9
198	CT17130-M-1-2-5-2-2-M	5	241	KCD 1	5
199	RC	3	242	WAS122-IDSA-1-WAS-B	5
200	SC	9	243	CT18510-23-4-4-1MP	3
201	HHZ1-Y4-Y1	7	244	NR2157-28-2-3-3-1	1
202	ZH1	3	245	. NR2160-90-1-5-1-1	1
203	IR09N516	3	246	.NR2167-41-3-2-3-1	1
204	IR10A227	1	247	NR2167-63-1-1-5-1-	0
205	IR10A267	3	248	NR2158-62-2-1-1-1	3
249	.NR2165-131-3-1-1-1	1	291	WANXIAN 7777	0
250	.NR2152-29-2-6-1-1-1-1-1	1	292	IR09L234	1
251	. NR2160-31-1-2-2-2-1	3	293	HHZ12-SAL2-Y3-Y2	1
252	RADHA-12 (Check)	0	294	HHZ5-DT20-DT3-Y2	0
253	IR 93405-B-B-96-2	7	295	HHZ5-SAL14-SAL2-Y2	0
254	IR 83388-B-B-8-3	5	296	HHZ8-SAL14-SAL3-Y2	0
255	IR 04A346	5	297	HHZ8-SAL6-SAL3-SAL1	1
256	NR 2154-8-1-1-1-1-1-1	3	298	HHZ8-SAL6-SAL3-Y1	1
257	NR 2164-43-3-1-1-1	1	299	RC	3
258	NR 2160-47-1-3-1-1	1	300	SC	5
259	RC	3	301	HHZ8-SAL6-SAL3-Y2	1
260	SC	9	302	Radha-4 (Check)	1
261	NR 2160-59-2-1-1-1	1	303	IR10L185	0
262	NR 2158-62-2-3-1-1	3	304	CT19021-3-5-2VI-1	3
263	NR 2188-3-2-4-1	0	305	IR10L357	1

S.N.	Genotype	Blast score (0-9)	Trt No.	Treatments	Blast score (0-9)
264	HUA 565	1	306	BINADHAN 7	1
265	HUANGHUA ZHAN	3	307	CT18493-2-1-1-3VI-3	1
266	IR 82870-48	3	308	SAGC-02	3
267	IR 10L 182	1	309	D4098	1
268	CT 19021-3-5-2VI-1	3	310	CT21397-1P-1P-1SR-3	5
269	WAS122-IDSA-1-WAS-B	3	311	NR2146-9-1-1-121	3
270	IROSN359	1	312	NR456-5-3-1-1-1-17	1
271	IRO7A 179	1	313	NR452-23-1-2-1-1-1-1	0
272	IROSN 170	3	314	S3382-2D-KN-4-1	1
273	IR 10N 270	5	315	NR2157-122-1-2-1-1	0
274	SAMBA MSULI SUB -1	0	316	IR75417-R-R-R-R-457-2	0
275	IR 10L 151	1	317	IR09L337	1
276	IR 9L 270	3	318	IR87707-182-B-B-B	3
277	B 11586-F-MR-11-2-2-11	3	319	RC	1
278	IR 55423-01	3	320	SC	7
279	RC	1	321	IR07L320	3
280	SC	9	322	IR09L204	1
281	RC8	3	323	IR08L363	1
282	UPR2729-15-1-1-1	1	324	IR09L305	1
283	08 FAN 4	0	325	HHZ5-Y4-SAL1-Y1	1
284	IR08L181	0	326	Radha -11	3
285	IR 08L 216	1	327	IR 87615-9-3-1-3	5
286	08 FAN 10	1	328	IR 77721 -93	1
287	SAGC-09	1	329	IR 81826-B_B-57	0
288	IR10L182	1	330	HUA 565	1
289	08FAN2	0			
290	IR09L342	0			

2.7.2 Wheat

Different wheat experiments were conducted at Rampur during 2014/15 at Rampur with the collaboration with NWRP, Bhairahawa. Five experiments namely; initial evaluation trial (IET), coordinated varietal trial (CVT), wheat varietal display (WVD), Nepal rain-fed nursery (NRN) and national wheat disease screening nursery (NWDSN). In IET 30 genotype were included and details of the results have been presented in Table-118. For grain yield significantly highest grain yield was produced by NL-1244 (3.8 t/ha) followed by NL-1249 and NL-1254 (3.6 t/ha). CVT included 20 wheat genotype and the details of result have been presented in Table-119. However for grain yield non-significant result was observed and highest grain yield was obtained from BL-4406 (3.4 t/ha) followed by BL-4407 and NL-1211 (3.3 t/ha), respectively. Wheat variety display was included 43 wheat genotype and planted in non replicated condition and yield and yield attributing characters were recorded. The details of all recorded traits have been presented in Table-120. Of the tested genotype Triticale was superior for grain yield production (5.2 t/ha) and followed by Dhaulagiri (4.7 t/ha) and BL-3623 (4.6 t/ha). Nepal rainfed nursery included 100 wheat genotype and planted in single replication. Most of the tested genotype produced more or less than 1 t/ha grain yield (Table-121). However, the genotype BL-3064/kiritatati/wbll-1 produced highest grain yield (2.05 t/ha) followed by PASTOR//HXN7573/2*BAU/3/WBLL-1 (2.0 t/ha). In national wheat disease screening nursery (NWDSN) 380 wheat genotype were included and planted in rod row methods. Rampur is hot spot for wheat leaf blight and it is major disease of terai and inner terai regions of Nepal and occasionally affected by stem rust and loose smut. For leaf blight disease among the tested genotype resistant to moderately resistant were recorded only 14 genotype.

Table 118. Results of wheat genotype tested in IET, 2071/72 at Rampur, Chitwan

S.N.	Genotype	50% heading	Panicle/ M2	Maturity days	Plant ht. (cm)	Spike leng (cm)	LB scoring	1000 gr. wt (grm)	Grain/ spikes	GY t/ha
1	NL-1236	78	309	118	88	10	96	41.6	41	3.1
2	NL-1237	76	349	117	89	9	97	40.1	50	3.1
3	BL-4577	72	327	117	92	9	99	41.9	49	3.0
4	BL-4581	76	304	117	107	10	83	43.8	43	1.8
5	BL-4598	77	288	118	90	10	72	39.9	42	3.1
6	BL-4599	77	278	118	89	9	97	56.1	30	2.8
7	BL-4605	80	339	117	98	10	96	48.6	41	3.0
8	BL-4606	71	347	115	105	11	98	36.2	36	3.5
9	NL-1238	70	379	116	97	10	72	48.9	45	3.0
10	NL-1239	77	302	118	91	9	96	44.3	39	2.9
11	NL-1240	85	342	118	88	9	73	40.8	53	2.4
12	NL_1241	78	378	118	94	9	51	46.7	43	2.5

S.N.	Genotype	50% heading	Panicle/ M2	Maturity days	Plant ht. (cm)	Spike leng (cm)	LB scoring	1000 gr. wt (grm)	Grain/ spikes	GY t/ha
13	NL-1242	78	277	118	93	10	85	45.6	52	3.2
14	NL-1243	77	363	117	90	9	96	43.5	31	2.8
15	NL-1244	77	352	117	103	8	95	49.0	35	3.8
16	NL-1245	77	308	117	95	10	95	53.8	37	2.9
17	NL-1246	78	352	118	90	9	72	47.4	35	2.2
18	NL-1247	77	401	117	93	9	97	40.5	37	3.0
19	NL-1248	78	369	119	87	9	98	51.9	34	2.9
20	NL-1249	78	347	118	90	9	94	48.5	46	3.6
21	NL-1250	73	425	116	89	9	96	40.1	38	3.0
22	NL-1251	77	383	118	92	10	95	44.4	50	2.0
23	NL-1252	81	315	119	89	9	97	43.9	50	2.9
24	NL-1253	71	353	115	84	9	96	41.1	32	3.2
25	NL-1254	75	363	116	86	9	75	50.6	33	3.6
26	NL-1255	68	373	115	93	9	96	46.3	40	3.2
27	Nl-1256	69	279	116	89	9	75	39.6	54	3.1
28	NL-1257	76	404	117	95	9	95	43.4	42	2.8
29	Gautam	75	317	117	96	11	98	48.6	36	3.5
30	Bhrikuti	74	341	118	90	10	74	42.9	45	3.4
	Grand mean	76	342	117	92	9.2				2.97
	F-test	**	ns	ns	**	*				**
	CV%	0.8	15.7	1.1	4.5	6.7				11.9
	$LSD_{0.05}$	1.2	110	2.7	8.5	1.3				0.72

Table 119. Results of wheat genotype tested in CVT, 2071/72 at Rampur, Chitwan

S.N.	Genotype	50% heading	Panicle/ 8M2	Plant ht cm	Spikes len. (cm)	Maturity days	1000 gr wt(grm)	Leaf blight	Grain/ spikes	GY t/ha
1	BL-4316	73	281	97	9	116	36.3	95	46	2.8
2	BL-4335	73	340	92	10	115	53.2	96	29	3.1
3	BL_4341	74	360	98	9	116	42.5	84	42	3.2
4	BL-4406	70	320	91	10	114	49.9	85	52	3.4
5	BL_4407	70	298	92	9	114	51.4	97	37	3.3
6	BL-4463	72	328	97	10	115	46.3	84	42	2.9
7	BL-4468	80	325	104	10	118	49.1	62	40	2.3
8	NL-1164	74	309	99	9	116	49.0	62	41	2.9
9	NL-1190	74	356	95	9	116	41.0	95	45	2.0
10	NL-1193	70	274	89	8	114	53.0	62	39	2.7
11	NL-1202	75	271	93	10	117	45.5	96	48	3.0
12	NL_1203	80	353	97	10	118	44.4	52	41	2.8
13	NL-1207	77	336	84	8	118	43.4	73	35	3.2
14	NL-1208	81	400	83	9	118	36.9	99	31	2.1
15	NL-1211	78	284	100	9	119	41.5	84	32	3.3
16	NL-1212	73	339	93	10	116	45.5	86	39	2.8
17	NL-1214	79	323	88	9	119	45.8	72	42	2.7
18	Bhrikuti	71	375	91	9	114	53.0	84	21	3.0
19	RR-21	69	401	96	10	114	44.1	85	54	2.1
20	Gautam	73	324	100	9	116	37.9	73	31	3.0
	Grand mean	74	330	94	9.2	116				2.8
	F-test	**	ns	ns	Ns	**				ns
	CV%	1.1	12.3	6.9	9	0.8				15.3
	$LSD_{0.05}$	1.8	84.5	13.6	1.7	1.9				0.9

Table 120. Results of wheat genotype tested in WVD, 2071/72 at Rampur, Chitwan

S.N.	Genotype	50% heading	Plant hight cm	spikes length (cm)	Leaf Blight	GY t/ha
1	LR-52	74	89	8	98	1.2
2	LR-64	76	95	8	98	1.1
3	Kalyan sona	73	93	9	97	3.2
4	Pitic-62	80	89	10	86	1.4
5	RR-21	69	109	10	98	3.8
6	NL-30	79	94	8	98	1.4
7	HD-1982	66	88	9	98	2.6
8	UP-262	71	101	8	97	3.4
9	Lumbini	68	97	9	98	2.2
10	Triveni	73	100	9	96	2.0
11	Vinayak	65	93	8	99	3.2
12	Siddartha	65	75	7	99	2.6
13	Vaskar	68	80	7	98	2.6
14	Nepal-297	63	87	8	97	3.2
15	Nepal-251	69	100	8	95	3.8
16	Annapurna-1	78	89	8	85	2.8
17	Annapurna-2	73	98	10	84	4.4
18	Annapurna-3	74	94	8	84	3.6
19	BL-1022	66	93	8	99	3.0
20	Bhrikuti	70	82	8	97	3.7
21	NL-1135	65	94	9	98	3.2
22	Annapurna-4	67	89	9	97	3.4
23	Achyut	78	88	9	97	2.3
24	Rohini	70	87	7	98	2.4
25	Kanti	78	93	9	97	2.0
26	Pasanglhamu	76	115	10	73	2.6
27	BL-1473	65	101	8	97	3.2
28	Gautam	75	103	9	75	2.8
29	WK-1204	77	90	8	96	3.0
30	Aditya	70	98	8	84	3.5
31	NL-971	76	97	8	73	4.3
32	Bijay	70	99	8	97	3.7
33	Gaura	75	96	8	97	2.4
34	Dhaulagiri	69	94	8	62	4.7
35	NL-1073	73	87	9	61	4.1

S.N.	Genotype	50% heading	Plant hight cm	spikes length (cm)	Leaf Blight	GY t/ha
36	NL-1064	83	98	9	52	3.0
37	BL-3623	71	91	8	73	4.6
38	BL-3629	72	96	9	73	3.8
39	BL-3872	79	97	8	62	3.2
40	NL-1055	75	91	8	72	3.2
41	NL-1164	75	99	9	84	3.6
42	Triticale	70	106	9	72	5.2
43	Durum	83	74	6	72	1.0

Table 121. Results of wheat genotype tested in NRN, 2071/72 at Rampur, Chitwan

S.N.	Genotype	50% head	pl ht cm	Length of spikes	LB	GY t/ha
1	Nepal-297/Kiritati/wbll-1	70	90	8	99	1.09
2	Anna-4/fret 2//kukuna// fret-2	70	92	9	99	1.30
3	Anna-4/fret 2//kukuna// fret-2	70	86	10	99	0.62
4	BL-3064/kiritatati/wbll-1	70	104	7	99	2.05
5	BL-2649/KIRITATI/3/HUW-234+LR34//PRL/VEE#10	76	105	9	98	1.63
6	BL-2189/KIRITATI/3/HUW-234+LR34//PRL/VEE#10	71	86	8	99	0.93
7	BL-2930/KIRITATI/WBLL- 1	76	98	8	97	1.37
8	BL-3565/WBLL-1×2/TUKURU	75	114	10	97	1.17
9	BHRIKUTI/KRITATI/2×PASTOR	67	81	7	99	1.13
10	BL-2884/FRET 2/TUKURU// FRET-2	71	106	9	95	1.39
11	BL-3235/WBLL-1×2/3/WERAVER/OCI//BORL/95	70	96	10	98	1.15
12	BL-3237/WBLL-1×2/3/WERAVER/OCI//BORL/95	72	109	10	99	0.81
13	BL-2892/KRITITA/KMB 1	71	110	9	99	1.18
14	BL-3625/KTITITA//HUW 234+LR34/PRINIA	70	83	8	99	1.01
15	BL-2931/KRITATI	76	104	8	99	1.24
16	BL-3400/PFAU/WEAVER//KRITTATI	81	80	9	97	1.02
17	BL-3716/WBLL 1×2/BRAMBRAMBLIMG	84	94	10	98	1.03
18	BL-1473/FRET 2/KUKUNA//FRET 2	83	97	9	97	1.41
19	KIRITATI/WBLL 1 BL 2730	75	109	9	97	1.57
20	BHRIKUTI	71	76	8	99	1.37
21	NING 8201//TUKURU	66	98	8	99	1.00
22	BL-3629/KIRITATI//SERI/RAYOM	71	85	9	99	1.36
23	NL;-1002/WAXWING/4/SNI/TRAP#1/3 / KAUZ×2/KAUZ	71	99	7	99	1.21
24	BL-3623KIRITATI//SERI/RAYON	74	83	9	99	1.62

S.N.	Genotype	50% head	pl ht cm	Length of spikes	LB	GY t/ha
25	BL-3817/KINGBIRD	74	92	9	98	0.41
26	BL-2940/KIRITATI//HUW 234+LR 34// PRINIA//BL3623	76	92	8	97	1.96
27	BL-3623/KIRITATI/3/HUW 234+LR34//PRL/ VEE#10//BL3625	66	83	8	99	0.92
28	BL-2818/THELIN#2/TUKUKRU	74	101	9	98	1.15
29	BL-3348/WAXWING×2/TUKURU	75	91	8	99	1.13
30	BL-2189/KIRITATI/3/HUW-234+LR34//PRL/ VEE#10/BL3623	84	88	9	97	1.42
31	BL-2860/KIRITATI/3/HUW 234+LR34//PRL/VEE#10//BHRIKUTI	71	101	10	97	1.78
32	BAGAULA/KIRITATI/3/HUW234+LR34// PRL/VEE#10/BL4158	78	84	9	99	0.60
33	BL3348/WAXWING×2/TUKURU	78	87	10	99	0.61
34	NL-971/KINGBIRD	81	78	9	98	0.62
35	WK 1204/KIRITATI//PRL/2×PASTOR//BL 4055	74	77	8	99	1.01
36	BL-3399/FRET 2/TUKURU//FRET 2/BL 4168	81	83	9	97	1.16
37	BL-3623/KIRITATI/3/HUW 234+LR34//PRL/ VEE#10//BL3625	74	91	7	98	1.12
38	NL-1110/NL 971	80	83	8	99	0.40
39	BL2818THELIN#2 TUKURU//CROC.1 AE SQ(205)//BOW	77	88	9	99	0.79
40	GAUTAM	75	80	8	99	0.60
41	BL-2860/KIRITATI/3/HUW 234+LR34//PRL/VEE#10//BHRIKUTI	82	79	9	98	0.81
42	PASTOR//HXN7573/2×BAU/3/WBLL-1	84	67	8	99	2.00
43	PASTOR//HXN7573/2×BAU/3/WBLL-1	76	72	10	99	0.20
44	PASTOR//HXN7573/2×BAU/3/WBLL-1	77	70	9	99	0.61
45	PASTOR//HXN7573/2×BAU/3/WBLL-1	79	74	9	99	0.59
46	PASTOR//HXN7573/2×BAU/3/WBLL-1	78	67	8	99	0.20
47	SOKOLL/WBLL-1	78	64	8	99	0.41
48	WORRAKATTA/2×PASTOR	84	58	6	98	0.38
49	1447/PASTOR//KRICHAUFF/3/PAURAQ	83	65	6	98	0.40
50	QING HAIBEI/WBLL-1//BRBT2/3/PAURAQ	84	63	8	95	0.62
51	BERKUT/MUU//DAPHAE#1	76	80	8	99	0.77
52	SLVS/3/CROC_1/AE SQUARROSA(224) OPATA/5/VEE/LIRA//VOW/3/BCN/4/ KAUZ/6/2×KA/NAC//TRCH	73	71	6	99	0.81
53	KA/NAC//TRCH/3/VORB	70	75	8	99	0.82

S.N.	Genotype	50% head	pl ht cm	Length of spikes	LB	GY t/ha
54	EMB16/CCBRD//CBRD/4/BETTY/3/CHEN/ AE.SQ//2×OPATA	68	71	7	99	0.62
55	WBLL1×2/4/YACO/PBW65/3/KAUZ×2/ TRAP//KAUZ×2/5/DEMAI 4	70	76	9	98	1.41
56	WBLLI×2/BRAMBLING/5/BABAX/LR42// BABAX×2/4/ SNI/TRAP#1/3/KAUZ×2/TRAP//KAUZ	78	78	9	97	0.80
57	FRANCOLIN31/WBLLI	73	63	8	99	0.41
58	FRANCOLIN#1//WBLL1×2/BRAMBLING	75	71	9	99	0.62
59	MUTUS/AKURI	75	64	8	99	0.62
60	VIJAY	70	73	7	99	0.80
61	MUU/5/WBLL1×2/4/YACU/PVW65/3/ KAUZ×2/TRAP//KAUZ /6/WBLL1×2/4/SNI/TRAP#1/3/KAUZ×2/ TRAP//KAUZ	77	75	9	99	0.40
62	MILAN/KAUZ//DHARWAR DRAY/3/ BAV92/4/PAURAQ	77	68	8	99	0.82
63	WORRAKATTA/2PASTOR//DANPHE#1	80	68	7	99	0.61
64	KA/NAC/TRCH/3/DAN#1	81	69	8	99	0.81
65	BEWKUT/MUU//DANPHE#1	77	74	8	98	1.31
66	C80.1/3×BATAVIA//2×WBLL1/3/EMB16/ CBRD//CBRD/4/CHEWINK#1	71	72	7	99	1.00
67	TOB/ERA//TOB/CNO67/3/PLO.4/VEE#5/5/ KAUZ/6/FRET2/7/PASTOR //MILAN/KAUZ/3/BAV92	74	77	10	99	1.42
68	TILILA/JUCHI/4/SERI.1B//KAUZ/HEVO/3/ AMAD	79	73	9	99	0.18
69	BAV92//IRENA/KUZ/3/ HUITES/4/2×ROLF07	77	71	8	98	0.62
70	FRET2/TUKURU//FRET2/3/MUNIA/CHTO// AMSEL/4/FRET2 /TUKURUY//FRET2	78	72	8	97	1.21
71	FRET2/TUKURU//FRET2/3/MUNIA/CHTO// AMSEL/4/FRET2/TUKURUY//FRET2	78	71	9	97	1.41
72	WBLL1×2/4/BABAX/LR42//BABAX/3/ BABAX/LR42//BABAX	79	69	8	99	0.40
73	WBLL1_1/4BOW/NKT//CVRD/3/CBRD/5/ WBLL1×2/TUKURU	71	71	9	99	1.01
74	FRANCOLIN#1//WBLL1×2/BRAMBLING	75	68	8	99	0.82
75	FRANCOLIN#1//WBLL1×2/KURURUTU	71	74	7	99	0.61
76	MUTUS/AKURI	75	73	9	99	0.79
77	MILAN/KAUZ//DHARWAR DRAY/3/ BAV92/4/CHONT	75	79	8	99	1.18
78	BERKUT/VORB/3/KA/NAC//TRCH	77	75	8	98	1.80

S.N.	Genotype	50% head	pl ht cm	Length of spikes	LB	GY t/ha
79	TOB/ERA//TOB/CNO67/3/PLO.4/VEE#5/5/ KAUZ/6/FRET2/7/PASTOR //MILAN/KAUZ/3/BAV92	77	72	9	99	0.96
80	NLN297	68	75	9	99	0.60
81	TOB/ERA//TOB/CNO67/3/PLO.4/VEE#5/5/ KAUZ/6/FRET2/7/PASTOR //MILAN/KAUZ/3/BAV92	75	73	9	99	0.81
82	KA/NAC//TRCH/3/DANPHE/1	77	79	8	99	1.12
83	KA/NAC//TRCH/3/DANPHE/1	76	72	8	97	1.57
84	TU1//2×SUNCO/SA1166/3/TU1/4/FINS1/5/ SOKOLL/6/KA/NAC//TRCH	76	73	7	98	0.94
85	EMB16/CBRD//CBRD/3/SUNCO.6/FRAME// PASTOR/4/MILAN/KAUZ//DHARWAR DRY/3/BAV92	75	79	8	99	1.20
86	KA/NAC//TRCH/3/SLVS/ATTILA//EBLL1/4/ KA/NAC//TRCH	76	73	9	99	0.60
87	EMB16/CBRD//CBRD/4/BETTY/3/CHEN/ AE.SQ//2×OPATA/5/KA/NAC//TRCH	72	71	10	99	1.01
88	EMB16/CBRD//CBRD/4/BETTY/3/CHEN/ AE.SQ//2×OPATA/5/KA/NAC//TRCH	74	76	8	99	1.17
89	TOB/ARA//TOB/CNO67/3/PLO/4/VEE#5/5/ KAUZ/6/FRET2/7/PASTOR //MILAN/KAUZ/3/BAV92	77	72	8	99	0.41
90	KA/NAC//TRCH/3/VORB	76	73	8	99	0.59
91	KA/NAC//TRCH/3/VORB	73	75	8	97	1.39
92	MILAN/KUZ//DHARWAR DRY/3/BAV92/4/ CHONT	82	65	8	98	0.59
93	WORRAKATTA/2×PASTOR//MUU/3/MUU	77	70	7	98	1.02
94	METSO/ER2000/4/PAT24/ALD//DOVE/ BUC/3/GONDO	77	70	8	98	1.16
95	METSO/ER2000/4/PAT24/ALD//DOVE/ BUC/3/GONDO	77	74	8	98	1.96
96	FRETE2/TUKURU//FRET2/3/MUNIA/ CHTO//AMSEL/4/FRET2/TUKURU/FRET	77	75	8	98	1.17
97	ATTILA×2/PBW65×2//MURJ	80	72	8	95	1.61
98	FRANCOLIN#1//WBLL1×2/KIRITATI	75	68	8	99	0.84
99	ALTAR 84/AE SQUARROSA(221)//3×BORL95/3/ UEES/JUN//KAUZ/4/WBLL1/5MUTUS	72	68	8	98	1.01
100	WK1204	77	69	8	99	1.00

3. Source Seed Production

Under source seed production program, NMRP produced 51.813 tons of maize seed, 24.231 tons of rice seed, 4.072 tons of wheat seed and 1.05 tons of sun hemp seed in the fiscal year of 2071/72. Seed production details are shown in tables 122 and 123.

Table 122. Seed production of different rice, wheat, sunhemp at NMRP, Rampur in 2071/72.

S.N.	Crop	Variety	Foundation Seed (kg)	Improved Seed (kg)	Total (kg)
1	Rice	Ramdhan	0	11202	11202
2		Sabitri	13029	0	13029
3	Wheat	Bijay	2678	0	2678
4		Gautam	1394	0	1394
5	Sun hemp	Sun hemp	1050	0	1050
	Sub Total		18151	11202	29353
	Mixed Rice				9180
	Mixed Wheat				815
	Grand Total				39348

Table 123. Seed production of maize at NMRP, Rampur in 2071/72.

S.N.	Variety	Breeder Seed (kg)	Foundation Seed (kg)	Improved Seed (kg)	Total (kg)
1	Rampur Composite	1481	15808	3930	21219
2	Arun-2	700	7100	5825	13625
3	Manakamana-3	1149	7626	5339	14114
4	Deuti	150	2275	50	2475
5	Poshilo Makai-1	110	270	0	380
	Sub Total	3590	33079	15144	51813
	Mixed maize				39000
	Grand Total				90813

4. Special Projects

4.1 Agriculture and food security project (AFSP)

Agriculture and Food Security Project (AFSP) is a one of the goverment emphasized project. In the fiscal year 2071/72, three groups of pipeline maize varieties were maintained and produced 400 kg breeder seed and 4000 kg foundation seed in NMRP (Table-124 and 125). Maize Breeder Seed of amount 1210 kg and 2760 kg foundation seed have been provided to the districts of AFSP command area (Table-126) two days maize seed production and handling training was organized to the two CBSP groups of Agriculture Research Station (ARS), Surkhet and Ginger Research Program (GRP), Salyan each at Regional Agricultural Research Station, Khajura, Nepalgunj on 6th and 7th of Asar, 2072. There were 5 participants each from four of the CBSP (Table-127). Beside this, (one electric maize seller, one digital balance (30 kg capacity) and 25 pieces of Purdue Improved Crop Storage (PICS) bags) have been provided to each CBSP group. Three maize varieties were relesed and two varieties are in the process of release (Table-128 and 129). In this project, one brochure of "Maize Production Technology" and one booklet of "Seed Production Technology of Maize" were published in this fiscal year.

Table 124. Name of pipeline maize varieties belonging to three groups.

S.N.	Group 1 (Foundation Seed)	Group 2 (Early Maize)	Group 3 (Quality Protein Maize)
1.	BLBSRS07F10	EEYC-1	S00TYWQ-B
2.	DTM#35	POOL-15	S01SIWQ-2
3.	DTM#38	S03TEY/LN	CLEYAS99-SIWQ
4.	HGA/HG-AB	POOL-27	S00TLWQ-B
5.	KLYPOP	ACROSS-2401	S03TLYQ-AB-01
6.	KSYN10	S97TEYGHAYB(3)	S01SIYQ
7.	KSYNF10	RC/POOL-17	S03TLYQ-AB-2
8.	MANAKAMANA-3	KY/POOL-17	
9.	RAMPUR S10F18		
10.	RAMPUR S10F20		
11.	RAMPUR S10F22		
12.	R-POP-2		
13.	TLBRS07F14		
14.	RPOP-3		

Table 125. Breeder and foundation seed produced under AFSP during 2071/72.

S.N.	Varieties	Categories	Amount (kg)
1.	Rampur Composite	Breeder	200
2.	Arun-2	Foundation	2000
3.	Rampur Composite	Breeder	200
4.	Arun-2	Foundation	2000

Table 126. Maize breeder and foundation seed sold/distributed to the districts of AFSP command areas in 2071/72.

S.N.	Seed Category	Varieties	Sold Amount (kg)	Project districts
1	Breeder Seed	Rampur Composite, Arun-2, Deuti, Manakamana 3, Posilo Makai-1	1210	RARS, Nepalgunj and Doti, ARS Surkhet; and Dailekh and GRP Salyan
2	Foundation Seed	Rampur Composite, Arun-2, Deuti, Manakamana 3, Posilo Makai-1	2760	DADO Rukum, Rolpa, Salan, Pyuthan, Surkhet, Darchula, Bajhang, Achham, Dadeldhura, Baitadi, Surkhet and Support Foundation, Dadeldhura.

Table 127. Name of the CBSP and number of participants of the training.

S.N.	Name of CBSP and Addresses	Number of participants
1	Karmachil Krishi Sahakari Sanstha, Dasharathpur-5, Surkhet	5
2	Parijat Krishi Bahumukhi Sahakari Sanstha limited, Dasharathpur-3, Surkhet	5
3	Saraswoti Biu Utpadan Krisak Samuha, Sidheswari-9, Salyan	5
4	Pachiwang Makai Biu Utpadak Krisak Samuha, Bhalakcha-4, Rukum	5

Table 128. Released varieties for project area

S.N.	Varieties	Maturity Day	Productivity (t/ha)	Recommendation Domain
1.	Arun-3 (Arun-1EV)	100	3.9	Mid western to Eastern Terai, Inner Terai and Mid hills; winter and spring season in Terai and Inner Terai, and summer season in mid hill
2.	Arun-4	113-115	4.2	Mid western to Eastern Terai, Inner Terai and Mid hills; winter and spring season in Terai and Inner Terai, and summer season in mid hill
3.	Arun-6 (Pool-17)	90	3.5	Mid western to Eastern Terai, Inner Terai and Mid hills; winter and spring season in Terai and Inner Terai, and summer season in mid hill

Table 129. Proposed maize varieties for project area.

S.N.	Variety	Recommendation Domain	Status
1.	Across 9942 × Across 9944	Mid hills	Proposed
2.	S99TLYQ-B	Mid hills and terai	Proposed

4.2 Kisan ka lagi unnat biu bijan karyakram (KUBK)

Kisan ka lagi Unnat Biu bijan Karyakram (KUBK) is a five years project. In fiscal year 2071/72, the foundation seed production program of two CBSP groups, one in each Gulmi and Arghakhachi district were supported by the project. The CBSP of Gulmi district named "Panitanki Jaibik Bahuuddeshiya Krisak Samuha" was provided Rampur composite and Manakamana-3 in 9 ha and 8 ha respectively as a community based seed production program. Similarly "Sustainable Community Development Centre (SCDC)" of Arghakhachi District was also involved in foundation seed production of Rampur composite in 10 ha area. Seed production supportive materials like breeder seed, urea, insecticide, seed bins, tarpaulins, jute bags (with logo of CBSP), jute bag sewing machine, weighing balance and maize seller were provided to both of the CBSP groups (Table-130 and 131). In addition to these, we also provided two days training about maize seed production and PVS techniques to both of the CBSP at National Maize Research Program (NMRP), Rampur, Chitwan on 29th and 30th Jestha, 2072. Altogether 24 participants from two CBSPs were benifited from the training events. Two Participatory Varietal Selection (PVS) trials in Arghakhachi district (Table-132) were also conducted in the fiscal year 2071/72. Regular monitoring of the foundation seed production activities of both CBSP to maintain the seed quality and for their sound management was

also completed in the project ficsal year. We coordinated with the Regional Seed Testing Laboratory (RSTL), Bhairahawa, Rupandehi for fulfillment of requirements for the certification process of the foundation seed produced by the CBSP.

Table 130. Materials supported to the CBSP group of Gulmi district

S.N.	Particulars	Specification	Quantity (Units)
1.	Seed	Breeder	510 kg
2.	Fertilizer	Urea	1000 kg
3.	Insecticide	Granular	25 kg
4.	Seed Bin	200 kg capacity	7 piece
5.	Large Tarpaulin	24 × 18	6 piece
6.	Small Tarpaulin	12 × 9	5 piece
7.	Jute Bags (with CBSP logo)	30 kg capacity	600 piece
8.	Jute Bag Sewing Machine	Electric	1 piece
9.	Digital Weighing Machine	30 kg capacity	1 piece
10.	Maize Sheller	Electric	1 piece

Table 131. Materials supported to the CBSP group of Arghakhachi district

S.N.	Items	Specification	Quantity (Units)
1.	Seed	Breeder	300 kg
2.	Fertilizer	Urea	500 kg
3.	Seed Bin	200 kg capacity	7 piece
4.	Large Tarpaulin	24 × 18	6 piece
5.	Small Tarpaulin	12 × 9	5 piece
6.	Jute Bags (with CBSP logo)	30 kg capacity	400 piece
7.	Jute Bag Sewing Machine	Electric	1 piece
8.	Digital Weighing Machine	30 kg capacity	1 piece
9.	Maize Sheller	Electric	1 piece

Table 132. Name of the pipeline varieties tested in the Participatory Varietal Selection (PVS) in Arghakhachi.

S.N.	Name of pipeline varieties
1.	Across 9331
2.	BGBYPOP
3.	TLBRS07F16
4.	ZM 401
5.	ACROSS 9942/ACROSS 9944

5. Technology Transfer and Services

The details of trainings, workshops, seminar, publications, services and information through media were given in Annexes.

5.1 Key Technologies

5.1.1 Varietal

Production domain	Recommended variety
High hills (>1500 m. asl)	Ganesh-1 and Ganesh-2
Mid hills (>1000 m. asl)	Mankamana-1, 2,3,4,5 and 6, Deuti, Sitala, Khumal Hybrid 2
Foot hills (Spring maize)	Rampur composite, Arun-1, Arun-2, Arun-3 and Arun-4, Arun-6
Terai/foot hills	Rampur composite
Terai (Winter maize)	Rampur hybrid-2 and Rampur composite

Promising NMRP hybrids: RML-32/RML-17, RML-4/RMl-17, RML-86/RML-96, RML-95/RML-96.

5.1.2 Crop management

No tillage with retention of previous crop residue i.e. conservation tillage (CT) under rice-maize system found superior in terms of grain yields of respective crops and their system yields, soil nutrient status (soil organic matter, nitrogen, phosphorus and potassium), cost of cultivation and hence net return, and non-lodging plants over the farmer's tillage practice of conventional tillage without the crop residue (FP). Include soil condition

Conservation tillage in maize reduced the impact of drought by lowering soil temperature and surface evaporation, hence increased grain yield.

In case of conservation tillage in maize, Atrazine herbicide (pre-emergence) application of Atrazine (50%WP) @1.5 kg ai./ha within 24 hours of planting and in case of no tilled dry direct seeding of rice, Pendimethalin 30% EC @ 6ml/ litre of water i.e 550 litres/ha within 48 hours of direct seeding found profitable.

Planting geometries of 60cm between rows and 25cm between plants for hybrids found suitable in Terai.

Tank mixture of Atrazine and Glyphosate (Atrazine @ 0.75kg a.i./ha + Glyphosate @2.5 ml/litre of water) or Atrazine (Atrazine @1.5kg a.i./ha as pre emergence) + one hand weeding at 40 days after seeding during spring season

maize found better for higher grain yield and net economic return in Terai, Nepal.

Nitrogen application @ of 180 kg N/ha in three splits (10% at planting, 30% at five leaf stage, 30% at 10 leaf stage and 30% at tasseling resulted the significantly higher grain yield of maize.

Cultivation of winter maize practice and Best time of planting for winter maize was last fortnight of September and for spring it was mid February in uplands of Terai.

For both tilled and no tilled condition, Chinese maize planter that drills the single seed per hill with 100% seed drilling efficiency found suitable for Terai and flat lands.

5.1.3 Plant protection

For Gray leaf spot (GLS) disease the resistant/tolerant varieties are; Manakamana-3,, Manakamana-5, Manakamana-6 (for mid-hills) & Ganesh-1 & Ganesh-2 (for high hills).

Rampur Composite (Thai Comp. x Suwan-1) & Sarlahi Seto (Philippines DMR-2)- released in 1975 for Downy mildew resistant. For head smut- Tilt (propiconazole) or Bayleton (triademeform) @ 2 g/kg seed has been found effective for the control of disease.

Seed treatment with Apron 35 SD (metalaxyl) @ 3 gm a.i./kg seed was found most effective for the control of downy mildew.

At Chitwan, early planting prior to 14th of May resulted in lighter borer infestation and less subsequent injury from the maize stem borer, than plantings later in the season.

For maize stem borer management, a commercial mixture of Chloropyriphos 50% and Cypermethrin 5% performed better as compare to Confidor 200SL and Furadan 3G whorl placement.

Maize grains treated with 5% dust of malathion and 2-3 tables of Aluminium phosphide (Celphos) per metric ton found effective to protect against storage pests. In the case of botanicals, Bojho (20 gm/Kg seed) found effective control to maize weevil, where the infestation was only 2.25% during the period of nine months of storage. Furthermore, Neem kernel seed powder @10 g/kg and timur @4g/kg of maize grain and Super grain bag® was found free from storage insect pests up to 6 months.

5.1.4 Soil fertility management

For spring and summer season maize the recommended doses of Nitrogenous fertilizer can be applied in splits i.e at 30, 45 and 60 days after seeding for the higher grain yield.

Maize hybrids produced the higher grain yield with 200:60:40 kg NPK/ha during winter in Terai.

Application of 180: 90: 60 N, P_2O_5 and K_2O plus FYM 10 t/ha for full season maize produced the higher grain yield thereby higher net return.

Incorporation of Sun hemp as green manure @ 7 t/ha of dry biomass within two months of sowing produced the good yield of winter maize and enhanced the soil nitrogen status.

6. Budget and Expenditure

6.1 Financial Summary

The total budget released from NARC Source during the year 2014/15was NRs 55,234,745.1. The total expenditure was NRs 53,978,042.2 and that constituted about 38.49 % staff expense, 39.68 % operational cost, 7.07% administrative cost and 14.75 % capital expense (Annex). The other funding sources were AFSP (IDA) (13.79 %), HTMA- CIMMYT (4.70 %), KUBK-GoN (7.41%), Multinational hybrid-Private comapnies (8.15%), CGIAR Soil- CIMMYT (15.26%), Nutrition maize –CIMMYT (30.11%), AFACI (0.85 %) and HMRP-CIMMYT (19.72%). NARC regular fund remained the major source and therefore, the funding source should be sustainable and the amount needs to be increased with time to run this program smoothly. The detail budget and expenditure of regulars as well as special projects are provided in Annex 11 & 12.

6.2 Revenue

The total revenue generated was NRs. 72,28,910.4 and the beruju amount cleared on this fiscal year was NRs. 29,500. The details of revenue generated and beruju status is provided in Annex 13 & 14 respectively.

7. Major constraints

7.1 Biological constraints

7.1.1 Diseases and pests in maize fields and stores

Smut (*Sphacelotheca reiliana*) and turcicum blight (*Helminthosporium turcicum*) in the eastern and midwestern/far-western midhills and highhills; ear rot in the central/western and mid-western/far-western midhills; stalk rot in the mid-western/far-western midhills, terai, and highhills; and downy mildew (*Perona sclerospora spp*.) and leaf firing in the terai were important diseases mentioned by farmers. Banded leaf and Sheath blight (*Rhizoctonia solani*) was increasing in severity and prevalence in all environments. Turcicum Leaf Blight is ubiquitous in hill environments and can cause severe losses if the variety does not have good genetic resistance. Gray leaf spot disease is emerging as problematic during rainy season in the hills.

White grubs (*Phyllophaga spp*. and *Cyclocephala spp*.), stem borers (*Chilo partellus*), and termites (*Microtermes spp. and Macrotermes spp*.) were major maize field insects in all agro-ecologies. Army worms (*Spodoptera spp*.,*Mythimna spp*) and cutworms (*Agrotis spp*. and other species) were also major problems in all agroecologies except the eastern midhills. Blister beetle was a major problem in the central/western and mid-western/ far-western midhills and the terai, and field cricket a serious pest in the eastern and mid-

western/farwestern mid-hills and highhills. Aphid (*Rhopilosiphum spp*.), locust, red ant, and tassel beetle were also reported by farmers. Weevils (*Sitophilus* spp.) and Angoumois grain moth (*Sitotroga cerealella*) were major problems in stored grain (Paudal et al., 2001) throughout the country.

7.2 Management

7.2.1 Soil fertility

Among important recent changes are a reduction in livestock numbers, forest degradation, and reduced availability of labor, development of community forest and stall-feeding of cattle led to reduction in amount of manure (Turton et al., 1995). The reasons for low use of chemical fertilizer included high cost, non-availability at key times and a lack of knowledge of their use. There are no updated recommendation on the doses of fertilizer for high yielding hybrids, winter, spring and summer season, rainfed and irrigated maize.

7.2.2 Plant population at harvest

One factor that contributes to low system productivity is faulty thinning practices that lead to sub-optimal plant populations at harvest. However, information on optimal plant populations is lacking for maize-millet systems in these regions (Karki et al., 2014). Farmers generally plant higher seed rates and keep the higher densities of plant (92000) during vegetative growth stage and later on reduce up to 30,000 plants per hectare at harvest. The recommended plant density of 53,333/ha seems quite low in case of hybrid and spring maize. Therefore, there is a need to recommend the appropriate plant population for different seasons, practices and varieties.

7.2.3 Weed infestation

Weed cause major yield losses worldwide with an average of 12.8 % despite weed control applications and 29.2% in the case of no weed control (Oerke and Steiner, 1996). The loss caused by weed in maize ranges 40-70% (Mandal, 2000) and yield loss depend on type of weed flora and its severity. At ARS Pakhribas (eastern mid hill of Nepal) experimental result showed weedy environment resulted yield reduction up to 70% in maize (Mishra 2004). None of the weed management practices are being adopted by farmers except manual weeding in maize.

Seed

Seed replacement rate (SRR) has remained very low against the desirable seed replacement rate for crops at 25% to 30%, average SRR is 9.00 % for wheat, 9.00 % for rice and 7 % for maize in 2009. Of the total requirements of the

cereal crop seeds, contribution of the formal sector is less than 10% and quality is a constraint to productivity. Large volume of low quality hybrid and other seeds are imported from India and distributed to the farmers through agrovets, especially in the bordering districts causing occasional crop failure in the past (MOAD, 2012).

7.2.4 Water management

The total irrigated area in Nepal is only about 1331521 ha (MOAD, 2014). More than two thirds of the maize is produced in the midhills and highhills during summer season and is mostly grown under rainfed condition. Delay in monsoon during planting, uneven distribution of rainfall and prolonged drought during crop season may affect the crop yield adversely. Water stress due to drought is probably the most significant abiotic factor limiting plant and also crop growth and development (Khalilli et al., 2013). The very limited area under winter and spring maize in Terai is irrigated.

7.2.5 Socio-Economic

Maize is predominantly grown in the hills and the farm sizes are also quite smaller compared to Terai region. Maize farming is therefore considered as subsistence farming in Nepal. It is regarded as a staple food of hill people. Staple commodities such as rice, wheat, potato and vegetables have higher commercialization rates (30-50%) than maize and fruits (15-25%) (ADS, 2014). The productivity is adversely affected by the shortage of agricultural labor (Joshi et al., 2012). Due to an inadequate policy intervention for prioritization of agriculture research, NARC, is suffering from inadequate operational budget as a consequence maize research is also being affected.

8. Way forward

8.1 Opportunities

There are tremendous opportunities to increase the maize production there by narrowing down the wider yield gap and horizontal expansion in winter season. Although maize yields increased slightly (0.5% per annum), the present level (2.458 mt/ha) has not kept pace with the rapid growth of the population (1.35 per annum). Poultry industries need about 664,000 mt of feed annually in the country where maize is a major source of it. Maize demand is increasing at the rate of 11% per annum in Nepal. To fulfill the growing demand of milk, meat and meat productions, we are importing about 45% of maize to be used for feed from India. while the import of food? items is reduced, the only option we have is to increase the production through vertical and horizontal expansion of agricultural commodities. Under such condition, maize can play the role of economic engine of the country due to maize being a high yielding cereal, its

area in Terai can be expanded during winter to feed the people and livestock. Furthermore, the special purpose maize like quality protein maize, sweet corn, baby corn and pop corn can also be grown in accessible areas to substitute the imports.

8.2 Emerging issues in maize production

The conventional maize production system needs to be converted into modern, resource use efficient and climate smart under the pretext of stagnant productivity as a result of limited area expansion, low yield potential of the existing genotype, imported hybrid seed, declining soil fertility, and emergence of new pest species, labour and water. Therefore, the research should focus on utilizing the latest tools of plant breeding for the development of stress resilient maize genotype, hybrid seed production effort, climate smart, and resource conserving agro-techniques like conservation agriculture.

1. Germplasm collection, exchange, evaluation and utilization
2. Development of stress (drought, heat, cold , low nutrient and high density resilient high yielding hybrids and open pollinated varieties of maize for different production ecologies
3. Long term research to develop the improved pest resistant germplasm that is adapted to nutrient deficiencies and other stresses need to be enacted
4. Application of modern tools of breeding like Marker-Assisted and Genomics for the fast track and precision breeding program in collaboration with CIMMYT and other concerned organizations
5. Low cost resource conserving production technologies
6. Source seed production and distribution system throughout the country
7. Development of quality protein maize for nutritional enhancement
8. Bridging the technology generation and delivery system through outreach research program
9. Collaboration with international CGIAR organizations and multinational companies
10. Strengthen the public-private partnership for technology generation and dissemination

Annexes

Annex 1 Area, production and yield of maize in Nepal.

S. N.	Regions	Agro-ecozones									Nepal		
		Mountain			Hill			Terai					
		Area (ha)	Prod (Kg)	Yield (Kg/ha)	Area (ha)	Prod (Kg)	Yield (Kg/ha)	Area (ha)	Prod (Kg)	Yield (Kg/ha)	Area (ha)	Prod (Kg)	Yield (Kg/ha)
1	Eastern	41500	98925	2384	169603	385266	2272	65150	183300	2814	276253	667491	2416
2	Central	32787	70756	2158	152589	410781	2692	37162	168618	4537	222538	650155	2922
3	Western	706	1115	1579	228711	577006	2523	14770	39112	2648	244187	617233	2528
4	Mid-western	7975	14367	1802	101024	195162	1932	35000	64400	1840	143999	273929	1902
5	Far-western	8000	12123	1515	24644	49696	2017	9140	12595	1378	41784	74414	1781
	Grand total	90968	197286	1887.6	676571	1617911	2287.2	161222	468025	2643.4	928761	2283222	2458

Source: MOAD, 2014

Annex 2. Monthly Agro-meteorological Data of the Station (Maximum Temperature, Minimum Temperature, Precipitation and Humidity)

Month	Avg. Max. Temp (^{0}C)	Avg. Min. Temp (^{0}C)	Total rainfall (mm)	Avg. RH (%)
July (2014)	33.66	26.75	517	87.00
August	32.95	26.38	795.7	85.74
September	32.57	25.33	206.56	86.40
October	31.44	21.12	85	86.06
November	28.13	15.82	0	74.56
December	22.29	11.64	9.5	75.64
January (2015)	21.44	11.35	14	73.56
February	24.95	13.10	40.9	70.54
March	29.05	20.19	43.7	71.52
April	32.50	20.85	21	75.35
May	35.63	25.23	198.5	77.85
June	35.42	26.55	306.8	76.57

(Source: NMRP, 2014)

Annex 3 Human Resources in 2071/72 (2014/15)

S.N.	Name	Position	Qualification	Specialization /Working area	Remarks
1.	Govind KC	Senior Scientist S4	M.Sc. Ag	National Maize Coordinator, Agronomy	Joined on 2071-12-16
2.	Dr. Keshab Babu Koirala	Senior Scientist S4	Ph.D.	Plant Breeding	Transferred to ARS Pakhribas from 2072-01-02
3.	Mr. Chitra Bahadur Kunwar	Senior Scientist S3	M.Sc. Ag	Plant Breeding	
4.	Mr. Tirtha Raj Rijal	Senior Scientist S3	M.Sc. Ag	Plant Pathology	
5.	Mr. Tika Bahadur Karki	Senior Scientist S3	M.Sc. Ag	Agronomy	
6.	Mr. Bandhu Raj Baral	Senior Scientist S3	M.Sc. Ag	Soil Science	Deputed to GRP, Salyan from 2071/12/17
7.	Mr. Santa Bahadur BK	Senior Technical Officer, T8	M. Sc. Ag	Agronomy	
8.	Mr. Hari Pd. Subedi	Senior Technical Officer , T8	B. Sc. Ag	Horticulture	
9.	Mr. Krishna Pd. Dhital	Senior Technical Officer T8	B. Sc. Ag	Agronomy	
10.	Mr. Min Raj Gautam	Senior Technical Officer, T7	I. Sc. Agri-engineering	Agri-engineering	Retired from 2071/12/08
11.	Mr. Ambar Bahadur Gurung	Senior Account Officer, A7	B. Com.	Account	
12.	Mr. Balaram Bhandari	Scientist S1	M. Sc. Ag	Plant Breeding	
13.	Mr. Ghanashyam Bhandari	Scientist S1	M. Sc. Ag	Entomology	
14.	Mr. Jiban Shrestha	Scientist S1	M. Sc. Ag	Plant Breeding	
15.	Mr. Mahendra Tripathi	Scientist S1	M. Sc. Ag	Agronomy	Leave on study from 2070/05/16
16.	Mr. Shiv Kumar Jha	Scientist S1	M.Sc. Agri-engineering	Agri-engineering	Leave on study from 2070/05/16
17.	Mr. Jagat Bandhu Adhikari	Scientist S1	M. Sc. Ag	Agronomy	Deputed from GLRP, Nepalgunj (joined from 2072/01/23)
18.	Mrs. Sarswati Neupane	Scientist S1	M. Sc. Ag	Entomology	Deputed from GLRP, Nepalgunj (Joined from 2071/09/18)

S.N.	Name	Position	Qualification	Specialization /Working area	Remarks
19.	Mr. Buddhi Bahadur Achami	Technical Officer T6	M. Sc. Ag	Entomology	
20.	Mr. Jhalak Bahadur Kshetri	Technical Officer T6	SLC	Plant Breeding/ Agri-extension	
21.	Mr. Govind Bdr. Hamal	Technical Officer T6	B. Com	Agri extension, Agri economics & Marketing	
22.	Mr. Ambika Aryal	Technical Officer T6	T SLC	Outreach	
23.	Mrs. Parbati Adhikari	Technical Officer T6	B. Sc. Ag	Soil Science	
24.	Mr. Jitendra Prasad Yadav	Technical Officer T6	I. Sc. Ag	Plant Pathology/ Agronomy	
25.	Mr. Surendra Yadav	Technical Officer T6	B. Sc. Ag	Plant Breeding	
26.	Mr. Sushil Nepal	Technical Officer T6	B. Sc. Ag	Entomology	Resignation from 2071/09/22
27.	Mrs. Shila Devi Sharma	Technical Officer T6	M. Sc. Ag	Entomology	
28.	Mr. Hem Sharma	Administrative Officer A6	IA	Administration	
29.	Mrs. Puspa Prabha Bhadari	Administrative Officer A6	IA	Administration	
30.	Mr. Binod Chandra Adhikari	Account Officer A6	B. Com/MA	Account	
31.	Mrs. Laxmi Devi Parajuli	Account Officer A6	B. Com	Account	Deputed to NCRP, Rampur from 2072/09/02
32.	Mr. Shyam Prasad Ghimire	Administrative Assistant A5	IA	Administration	
33.	Mr. Gopal Bhandari	Technician T5	M. Sc. Ag	Entomology /breeding	
34.	Mr. Hari Prasad Sharma	Technician T5	B.Sc. Ag	Pathology	
35.	Mr. Bhimbahadur Parajuli	Technician T5	Literate	Workshop	
36.	Mr. Dil Bahadur Gurung	Technician T5	Literate	Workshop	
37.	Mr. Janarjan Khanal	Administration A5	I.A.	Administration	Deputed to ORP, Sarlahi from 2072/03/01
38.	Mr. Pratik Hamal	Technician T5	I. Sc. Ag	Plant pathology	Deputed to NCRP, Rampur from 2072/01/14

S.N.	Name	Position	Qualification	Specialization /Working area	Remarks
39.	Mr. Anjan Pathak	Technician T5	I. Sc. Ag	Entomology	
40.	Mrs. Ranjana KC	Technician T5	I. Sc. Ag	Plant breeding	
41.	Mrs. Mira Shrestha	Technician T5	Literate	Plant Breeding	
42.	Mr. Ram Kumar Chaudhari	Technician T4	Literate	Soil science/Electrician	
43.	Mr. Ram Prasad Neupane	Technician T4	Literate	Seed production/ Breeding	
44.	Mr. Nanda Lal Dhakal	Technician T4	Literate	Plant Breeding	
45.	Mr. Jham Lal Subedi	Technician T4	Literate	Seed production	
46.	Mrs. Maiya Giri	Technician T4	SLC + Training	Plant Breeding	
47.	Mr. Shishir Adhikari	Technician T4	SLC + Training	Plant Breeding	
48.	Mr. Dal Bahadur KC	Technician T4	SLC + Training	Plant Breeding	
49.	Mr. Khem Raj Pathak	Technician T4	SLC + Training	Plant Breeding	
50.	Mr. Sunram Titung	Technician T4	SLC + Training	Plant Breeding	
51.	Mr. Narendra Bahadur Gurung	Driver	Literate	Workshop	
52.	Mr Budha Bahadur Rana	Driver	Literate	Administration	
53.	Mr Parshuram Ghimire	Technician LLT-5	Literate	Administration	
54.	Mr. Juddha Bahadur Rai	Technician LLT-5	Literate	Seed store	
55.	Mr. Himlal Bohara	Technician LLT-5	Literate	Soil Science	Retired from 2071/11/01
56.	Mr. Tirtha Raj Bhattrai	Technician LLT-5	Literate (Test Pass)	Plant pathology	
57.	Mr. Chitra Bahadur Bagale	Technician LLT-5	Literate	Security	

S.N.	Name	Position	Qualification	Specialization /Working area	Remarks
58.	Mr. Hari Bahadur Khadka	Technician LLT-5	Literate	Agronomy	
59.	Mr. Ganesh Prasad Ghimire	Technician LLT-5	Literate	Administration	
60.	Mr. Bishnu Prasad Devkota	Technician LLT-5	Literate	Outreach/ Multi-location trial	
61.	Mr. Purna Bahadur Tamang	Technician LLA-4	Literate	Workshop	
62.	Mr. Balkrishna Ghimire	Administration LLA-4	Literate	Workshop	Deputed from GLRP, Nepalgunj (Joined from 2071/12/23)
63.	Mr. Krishna Prasad Dabadi	Technician LLT-3	Literate	Plant Breeding	
64.	Mrs. Tara Ghimire	Technician LLT-3	Literate	Plant Breeding	
65.	Mr. Shambhu Prasad Bhatta	Technician LLT-4	Literate	Administration	
66.	Mr. Gagan Bahadur Kathayat	Administration LLA-2	Literate	Administration	

Annex 4 Summaries of NARC Research Projects and Activities in 2071/72

SN	List of Project/activities
1	Marker assisted backcrossing to transfer GLS (Gray Leaf Spot) resistance genes to improve available OPVs and inbreds targeted for Mid-hills
2	Study of bionomics of Armyworm (*Mythimna* spp) and their eco-friendly management using of bio-rational alternatives
3	Evaluating the performance of hybrid and OPVs maize varieties under conventional and no tillage with residue management practices in the Terai of Nepal
4	Mass rearing and application of Trichogramma against maize stem borer at NMRP seed production blocks
5	Maize research and development in Nepal
6	Plant nutrient management, effect and economic aspects on maize and soil environment
7	Evaluation and verification of the conservation agricultural based crop management practices under maize system in Nepal
8	Enhancing the livelihood of farmers through intercropping maize based system
9	Management of maize storage pest in Rampur condition
10	Agriculture engineering research for increasing maize production with reduced cost and drudgery
11	Enhancing maize productivity through improvement in agronomic management practice in Terai and inner terai
12	Development of conventional and non-conventional hybrid maize varieties for different production environments of Nepal
13	Breeder and Foundation seed production of maize and other crops
14	Participatory technology verification and dissemination (PTVD) at NMRP OR sites
15	FMP/AOE

Annex 5 Production of name of commodities/products in FY 2071/72

Annex 5.1 Seed production of different rice, wheat, sunhemp at NMRP, Rampur in 2071/72.

S.N.	Crop	Varieties	Foundation Seed (kg)	Improved Seed (kg)	Total (kg)
1	Rice	Ramdhan	0	11202	11202
2		Sabitri	13029	0	13029
3	Wheat	Bijay	2678	0	2678
4		Gautam	1394	0	1394
5	Sun hemp	Sun hemp	1050	0	1050
Sub Total			18151	11202	29353
Mixed Rice					9180
Mixed Wheat					815
Grand Total					39348

Annex 5.2 Seed production of maize at NMRP, Rampur in 2071/72.

S.N.	Varieties	Breeder Seed (kg)	Foundation Seed (kg)	Improved Seed (kg)	Total (kg)
1	Rampur Composite	1481	15808	3930	21219
2	Arun-2	700	7100	5825	13625
3	Manakamana-3	1149	7626	5339	14114
4	Deuti	150	2275	50	2475
5	Poshilo Makai-1	110	270	0	380
Sub Total		3590	33079	15144	51813
Mixed maize					39000
Grand Total					90813

Annex 6 Training/ Workshop/Seminar organized in FY 2071/72

S.N.	Name of training/ workshop/seminar	Duration	Target Group	Location	No. of participants
1.	SMS training on maize agronomy, breeding, seed production, pathology	4 days	SMS of extension offices & researchers from collaborative research stations	NMRP, Rampur	35 (Two Slots)
2.	Maize seed production and handling	2 days	Farmers	RATC Nepalgunj	20
3.	Maize seed production and PVS training	2 days	Farmers	NMRP, Rampur	24

Annex 7 Service Provided in FY 2071/72

S.N.	Service provided	Numbers	Major clients
1	Information provided related to maize cultivation techniques and research updates	5000	Farmers, NGOs members, students and Cooperative members
2.	Residential Facility (Guest house)	2500	Farmers, NGOs members, students Cooperative members, Government staffs

Annex 8 Publications in FY 2071/72

S.N.	Name of Publications	Type	Language	Authors	No. of copies
1.	Annual Report of NMRP	Book	English	NMRP	150
2.	Gyanlahar	Book	Nepali	NMRP	500
3.	Maize stem borer management through Trichogramma wasp	Leaflet	Nepali	G.S. Bhandari	1000
4.	Prospects of botanicals in crop pest management	Leaflet	Nepali	G.S. Bhandari	1000
5.	Soil fertility management in maize	Leaflet	Nepali	P. Adhikari	1000
6.	Makaibalima Lagne Mukhya Mukhya Rogharu Tatha Rokthamka Upayaharu	Leaflet	Nepali	T.R. Rijal	1000
7.	Makaiko Biu Utpadan Prabidhi	Leaflet	Nepali	B. Bhandari, J. Shrestha and GS Bhandari	1000
8.	Makaibalima Antar Bali Prabidhi	Leaflet	Nepali	TB Karki, G. KC and KP Dhital	1000
9.	Makaika Chadai Pakne Naya Unmochit Jatharu Arun-3, 4 & 6 Abam Tesko Kheti Prabidhi	Leaflet	Nepali	CB Kunwar	1000
10.	Makai Utpadan Prabidhi	Leaflet	Nepali	J. Shrestha & B. Bhandari	1000
11.	Final technical report- Best crop management practices for enhancing maize production and productivity in Nepal	Bulletin	English	BR Rijal	100
12.	Final technical report – Identification and dissemination of farmers preferred nutritious maize varieties suitable for food, feed, sillage and fodder in Nepal	Bulletin	English	KB Koirala	100

Annex 9 Training/Workshop/Seminar attended by staff in FY 2071/72

S. N.	Name of Staffs	Position	Name of training/ seminar/workshop	Duration	Place/country	Organizer
1.	KB Koirala, TR Rijal & B. Bhnadari	S4, S3 & S1	HTMA Workshop	3 days	Raichur, Andhrapradesh, India	CIMMYT
2.	KB Koirala & BB Achami	S4 & T6	12th Asian Maize Conference	3 days	Bangkok, Thailand	CIMMYT
3.	GS Bhandari	S1	South Asia Agricultural Science & Technology training	15 days	China	Yunnan Academy of Agricultural Science, China
4.	TR Rijal	S3	Plant pathological workshop	2 days	Khumaltar, Nepal	PPD, NARC
5.	TB Karki	S3	Maize Intercropping Technology	5 days	Kathmadu, Nepal	ICIMOD/DOA
6.	GS Bhandari, S. Neupane and BB Achami	S1 & T6	Inception workshop on entomological research and methodology	7 days	Khumaltar, Nepal	Entomology division, NARC
7.	GB Hamal	T6	SMS training on wheat production technology	3 days	Bhairahawa, Nepal	NWRP, NARC
8.	KB Koirala, CB Kunwar, TR Rijal, TB Karki, BR Baral, KP Dhital, GS Bhandari, J Shrestha, B Bhandari, S. Neupane, BB Achami , P Adhikari	S4, S3, S1, T8 & T6	Summer crop workshop	2 days	Dhanusha, Nepal	NARC

Annex 10 Paper Published in FY 2071/72

S.N.	Title of paper	Authors	Name of Proceedings/Journals
1.	Maize Production under No-Tillage System in Nepal.	TB Karki, TB and J. Shrestha	World Journal of Agricultural Research, 2014, Vol. 2, No. 6A, 13-17. DOI:10.12691/wjar-2-6A-3
2.	Preface to Special Issue on Conservation Agriculture for Sustainable Intensification.	TB Karki, TB J. Shrestha, J. And M. Tripathi	World Journal of Agricultural Research, 2014, Vol. 2, No. 6A. DOI:10.12691/wjar-2-6A
3.	Conservation Agriculture: Significance, Challenges and Opportunities in Nepal.	TB Karki, TB and J. Shrestha	Adv Plants Agric Res 1(5): 00029. DOI: 10.15406/apar.2014.01.00029.
4	Tillage Affects the Soil Properties and Crop Yields.	TB Karki, TB and J. Shrestha	Proceedings of the second national soil fertility research workshop. 24-25 March, 2015, Soil Science Division, NARC, Khumaltar
5	Conservation Agriculture: An Eco-friendly System of Weed Management in Field Crops.	TB Karki, TB and J. Shrestha	Int. J. Env. Volume-3, Issue-4, Sep-Nov 2014.
6	Studies on the Conservation Agriculture based practices under maize (Zea mays L.) based system in the hills of Nepal.	TB Karki, N. Gadal and J. Shrestha.	International Journal of Applied Science and Biotechnology. Vol-2(2) June, 2014.
7	Systems optimization through tillage and residue management and cropping system in maize based system.	TB Karki, N. Gadal and J. Shrestha.	Int. J. Curr.Microbiol.App.Sci (2014) 3(10) 990-1002.
8	Seasonal variation in stem borer damage of maize at Chitwan Nepal	BB Achami, GS Bhandari, P. Thakur, SB BK	In Book of 12th Asian Maize Conference and expert consultation on maize for food, feed, nutrition and environmental security, Bnagkok Thailand

Annex 11 Regular annual budget and expenditure record of FY 2071/72 (2014/15)

(In 000 Nepalese rupees)

Code	Budget heads	Annual budget released	Expenses	Balance
40 JK	Staff expenses	20891.7451	20777.087	139.65811
41 JK	Operational expenses	21538	21420.6272	117.37279
42 JK	Administrative expenses	4130	3819.24801	310.75199
43 JK	Capital expenses	8675	7961.08004	713.91996
	Grand total	55234.7451	53978.0422	1281.70285

Annex 12 Special project budget and expenditure record of FY 2071/72 (2014/15)

(In Nepalese rupees)

Name of the Project	Funded by	Project period	Annual budget	Expenses
AFSP	IDA		2755000	2373384.95
HTMA	CIMMYT		940000	819122.99
KUBK	GoN		1480000	755462.36
Multinational hybrid	Private companies		1628000	1511308.33
CGIAR Soil	CIMMYT		3049767.28	2424117.93
Nutrition Maize	CIMMYT		6016500	5076236.50
AFACI			169367	149400
HMRP	CIMMYT		3939872.96	3703934.17

Annex 13 Revenue status of FY 2071/72

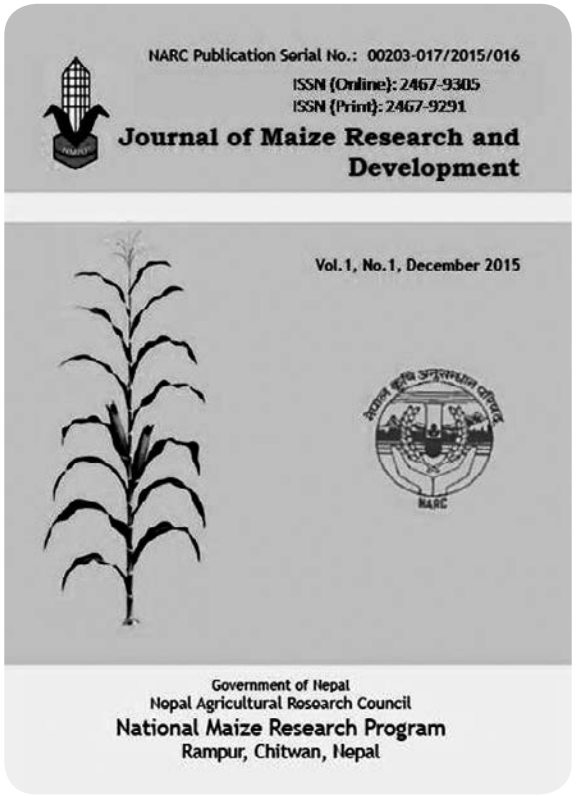
(In Nepalese rupees)

5000	Total	Remarks
Crop (Maize, wheat, Rice and other)	6117938.5	
Others (Admin) – Asset & guest house facility	1110971.9	
Grand total	7228910.4	

Annex 14 Beruju status of FY 2071/72

(In Nepalese rupees)

Beruju	Amount	Remarks
Beruju till last year	577750.37	
Beruju cleared this FY	29, 500	
Remaining Beruju	548250.37	
Document processed for clearance of Beruju	63,300	



Journal of Maize Research & Development Published by NMRP, Rampur: to be published once a year during December

NARC'S ED visits the Experimental block at NMRP

Observation visit of farmers at NMRP Research Block

GLS experiment at farmers field of Suping Makwanpur, 2072

Diamond trial of maize at outreach site 2071

Maize stem borer management experiment at NMRP Rampur, 2071-72

Seed Production Block at NMRP, Rampur

Maize Seed Production activities at NMRP

Publications of NMRP during 2071-72

Improvement of Arun-3, Arun-4 and Arun-6 at NMRP, Rampur