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EFFECT OF CROP INTENSIFICATION PROGRAM ON MAIZE PRODUCTION IN NYAGATARE, RWANDA.

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ABSTRACT: *This study was conducted in Nyagatare district located in the Eastern Province of Rwanda. Its objective was to assess the effect of the Crop Intensification program (CIP) on maize production in Nyagatare district. Improved seeds, Inorganic fertilizers, Extension services and Land Use Consolidation were the major variables for consideration in this study and assessment was made as to the contribution they made to maize production in CIP in the study area . The study focused on 24 cooperatives with 97 respondents. It used qualitative approaches to generate the opinion of respondents where data was not readily available and also quantitative methods where both primary and secondary data were used. Primary data was collected using questionnaires from random sample of 97 farmers, and it considered the socio-economic characteristics of farmers while Secondary data was collected from different sources, like Ministry of Agriculture, District offices, Agriculture Sector working Group (ASWG) reports , books, reports and internet.. The research used correlation and regression techniques Research findings revealed that youth and educated people's engagement in agricultural activities is minimal, that Extension services has not influenced maize production significantly and also that men constitute a bigger proportion of the agriculture work force than women creating a gender gap in the sector. Improved seeds influence significantly maize production more than other independent variables in this study .*

KEYWORDS: Agro-dealers, Agricultural inputs, Cooperatives, Crop Intensification program, Extension services, Land Use Consolidation, Production, Productivity

INTRODUCTION

This chapter focuses on the General background of the study, Statement of the problem, General objective, Specific objectives, Research questions, Justification of the study and, Limitations of the study.

Background to the study

As the Global population grows, there has been a corresponding increased demand for the agricultural products and space for habitation. This has remained a global concern whilst remedies and mitigation measures remained at their lowest. Because of the population pressure on the land, and further sub-divisions on it, mechanization has been rendered impossible on such land, production costs remained high as the means of production is human labor and therefore the products have remained uncompetitive on the markets where the owners of the big land mechanize enjoy the economies of scale . This has crippled Small Scale farmers as they cannot have the capacity to produce surplus for the growing market (Mulinga, 2013).

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In Rwanda, between 2003 and 2007 agricultural growth rate was at 2%. This trend, coupled with the aggressive need to pull Rwandans out of poverty, policies were devised to make the sector grow. This saw the growth moving from 2% by 2007 to 7% (2011-2012). This was attributed to the following policies.The policy on intensification and development of sustainable production systems. This was withthe aim to create the needed soils and water management structures to demonstrate to farmers the benefit of fertility enhancing technologies. The policy to support the professionalization of the producers. This was aimed at strengthening the sector's social capital base and provides producers with the organizational framework necessary to develop commercial linkages. Promotion of commodity chains and agri-business development. This entailed creating a conductive environment to business and entrepreneurship development as well as market access, development of traditional exports ,development of non-traditional high-value exports, development of market oriented rural infrastructure and strengthening rural financial system.

Policy for Institutional development which aimed at developing the institutional framework through which the public sector supports agriculture development. Since the implementation of the Crop Intensification Program, yields have also grown significantly.Post-harvest infrastructure investments and subsidized transport has improved product quality and market accessibility. As a result of these interventions, production of maize, wheat, roots and tubers, soybeans, rice and cassava as well as meat and milk, horticulture products have increased. Production increases have had a positive impact on both sector growth and reducing rural poverty.

Under the first Comprehensive Africa Agricultural Development Program (CAADP), Rwanda has since increased its agriculture funding by 13% of the total budget, reformed its crop intensification programs by focusing on land consolidation, use of fertilizers and improved seeds. In this regard, Agriculture is explicitly recognized in the second Economic and Poverty Reduction Strategy) as being one of the four priority sectors of the economy that will both stimulate economic expansion and make the greatest contribution to poverty reduction. It is expected to grow by 7%, to constitute a 27.7% share of GDP and to significantly contribute towards the targeted 28% export growth. Increasing agriculture productivity and food security required adopting modern input use and building the capacity of farmers to enhance land productivity potentials. It is against this background that the Ministry of Agriculture developed the Crop Intensification Program (MINAGRI, 2013). This report points out that Crop Intensification Program is a flagship to attain the goal of increasing agricultural productivity. In a bid to attain sustainable development, CIP focused on the following areas namely; Sustainable management of natural resources, Marshland and Irrigation development ,supply and use of inputs, food and nutrition security and vulnerability management. CIP aims at accomplishing this goal by significantly increasing the production of food crops across the country. The CIP takes the multi-pronged approach of facilitation of input (fertilizers, improved seeds), consolidation of land use, provision of extension services and to some extent, improve post harvest handling and storage mechanisms.

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CIP focuses on 6 priority crops namely, maize, rice, wheat, Irish potatoes, beans and cassava. Access to inputs has long been inhibiting farmers to raise productivity levels. This access has long been curtailed by low demand and costs which are further amplified by the transport difficulties in rural areas. To overcome these constraints, CIP adopted a 'supply-push' approach where by government initially supplied the inputs and persuaded farmers to use them. Progressively, the supply of these inputs have been put in the hands of private operators but government subsidy still remains though at diminishing pace until it completely weans as the farmers capacity to demand for inputs increase.

Also under CIP, government imported improved seeds from the neighbouring countries such as Kenya and Tanzania for different varieties. Example,in 2008,close to 765MT of maize seeds and wheat were imported for cultivation in season A. The amount gradually grew to 3,512 in 2011A (MINAGRI 2011). Under CIP, the use of improved seeds has increased which in turn has led to increase in maize production overtime. This has been through encouraging farmers to adopt use of improved maize varieties which give higher yields and economic returns compared to the local varieties. With the exception of hybrid maize seeds, the Open Pollinated Varieties(OPVs) of maize, are multiplied by RAB through seed multipliers under the supervision of service providers. Example is in Nyagatare district, where this has been done by Rwanda Development Organization-RDO which is a local NGO operating in this area .

Since the use of inputs such as improved seeds and inorganic fertilizers can only be translated into profitability for small holder farmers if the land fragmentation is overcome and the land use pattern to be organized. With the help of the land policy reforms, CIP advocates for consolidation of land use by users. This entails putting together different land parcels by land owners to consolidate the use of farm holdings. Under this mechanism, farmers are able to grow the same crop on the consolidated piece of land which eases extension and mechanization as well as controlling crop diseases under same area. This not only increases productivity but also environmental sustainability.

The extension services under CIP is performed by various extension agents that either public(from the sector and district levels)as well as from private sector and Civil Society who usually are service providers hired by the Government or funded by other development partners to perform these duties. Rwanda Agriculture Board-RAB coordinates the extension services and serves as a nodal agency for knowledge dissemination and other consulting services for farmers in the country.

Objectives of the study

General objective

The over all objective of the study was to assess the effect of Crop Intensification Program -CIP on maize production in Nyagatare District.

Specific objectives

Specifically the study intended:

1. To Analyze the Effect of improved maize seeds to maize production .

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2. To Examine the relationship between fertilizer usage and Maize production
3. To assess the role of extension services to maize production.
4. To analyze the contribution of Land Use Consolidation to maize production.

The Study hypotheses

The study tested the following hypotheses:

1- Fertilizers do not have direct effect on maize yields
2- Inorganic Fertilizers have not influenced maize production
3- Land Use Consolidation does not contribute to increased maize production
4- Extension services have not contributed to increased maize production in CIP

THEORETICAL FRAMEWORK

Rwanda's current agricultural status and orientation for the future entails primarily, the stepping up of activities that develop and promote agricultural and livestock production. This is envisaged to be achieved by means of intensifying the use of inputs and modern techniques in crop production and animal husbandry; prudent use of land and water; agricultural commercialization; and the strengthening of research capacity and extension services.

The 1980s and the 1990s featured slow and negative trends in agricultural production at the rates of 0.5% and - 4% respectively (the latter owing to the 1994 genocide). This economic growth trend reflects a tight resource base, declining soil fertility, and an extreme low use of modern inputs (improved seeds and inorganic fertilizers). To reverse this decline and pathetic performance, it was necessary to encourage changes in production techniques, including the intensive use of modern and better inputs.

While land consolidation seems to mean the same all over, objectives and procedures differ from one country to the other. It was in the same vein that in Rwanda it was borne out of concrete conditions and context forged out of its policy developments. Its objectives were the enlargements of the farm size and land use planning. The major driving force for this land consolidation was due to the existing land fragmentation This was because of its cause of inefficiencies in production and involves large costs to alleviate its effects Land consolidation in Rwanda was in terms of use of land not consolidation in terms of ownership (Musahara 2004, and Huggins, 2006).

On the other hand, while the usage of inputs in consolidated land areas has increased significantly, efficiency gains through further deployment of improved varieties, mechanization and natural resource management remains untapped .Application rates for fertilizers still remain below recommended levels for these crops and others, thus the need for accelerated mechanism to enhance the application of fertilizers in order to realize the full potentials of agricultural gains. Likewise, sufficient quantities of quality seeds are a critical resource for agriculture development. Today in Rwanda, there is a strong private and public sector involvement in seed sector component which pushes the distribution and supply of good quality seeds. This has increased productivity but not to the desired levels (KATHIRESAN, 2012).

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Though the inorganic fertilizers and improved maize varieties improve yields, the magnitude of the effect of the technologies on yields depend on whether a farm households adopt a complete package that is influenced by a good proximity extension services. However, substantial gaps in knowledge exist as the productivity impact of the package is influenced and shaped by other factors that include farmers themselves and their farm sizes among others as well as the quality of the package delivered. During the African Forum For Agricultural Advisory Services, (AFAAS) meeting in Kigali on July 10, 2012, the then Deputy Director General at RAB in charge of Agriculture Extension ,Innocent MUSABYIMANA said that according to the survey that had been carried out, it showed that agriculture advisory service providers in the country are able to reach only 32% of the farmers in the country.

Eight years from the introduction of CIP, and despite efforts deployed by the Government in a bid to promote the crop Intensification Program, a lot still remain desired. Maize productivity has remained below targeted levels of 6MT/Ha, and application rates for fertilizers still remain below recommended levels for these crops and others

MATERIALS AND METHODS

Introduction
This study was conducted in Nyagatare district located in the Eastern Province of Rwanda. Its objective was to assess the effect of the Crop Intensification program (CIP) on maize production in Nyagatare district. In this chapter the researcher describes the procedures followed in the research process. Specific aspects covered include the research design, population, sampling frame, sample and sampling techniques, instrument, data collection procedures, data processing and analysis.

Research design
The research design in this research used both quantitative and qualitative methods. It used quantitative approach because it was to capture data that was analyzed to assess the contribution of the independent variables to the maize production. With it, findings are in form of statements, tables or figures. Quantitative analysis was used to capture social trends and policy implications. Also during this research, qualitative methodology was employed to assess the opinion and perceptions of farmers on the CIP vis-à-vis maize production in Nyagatare district. This was through the interviews with the respondents during the research. However, during the interviews, there was need to ask the respondents what the trends mean to them or how they perceived the CIP policy. The qualitative analysis also helped to understand the patterns in the quantitative analysis.

Population
As the study looked at the contribution of CIP on maize production in Nyagatare district, the study population constituted the maize growers in the district of Nyagatare. In total, there were 2,799 maize farmers grouped in 24 cooperatives. Of these, 1,683 were men and 1,116 were women.

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3.2.1. Sample size determination.

To get the number of respondents, *n*, and estimated population N , the research used Slovin formula :

$n = \frac{N}{1+N(r2)}$ where r= sampling error; N= population, and n= sample size

.

Using the formula

$n = \frac{N}{1+N(r2)} = \frac{2799}{1+2799(0.1X0.1)}$

$= \frac{2,799}{28.99} = 97$

Therefore, the sample size used was 97 respondents randomly selected from 24 cooperatives.

Sample size determination

This research used Stratified random sampling because the population was not homogeneous among all the members in the 24 cooperatives. In this regard, during the research, stratified sampling methods was used to select the respondents from the cooperatives. Here you divide the total number in a cooperative (R) by the total number of population (N) and multiply the coefficient with the sample size n to the number of respondents in the cooperative (R÷N) × n. In order to get the n^{th} value to be used in selecting the respondents from the list of cooperative members, you divide the total number of cooperative members by the sample size for each cooperative (R÷N) × n. . Sufficient number of both sexes was selected to represent other farmers .Purposive sampling was done to capture the information from targeted and useful respondents like leaders of cooperatives, union leaders, or representatives of different departments and concerned institutions.

Source of data

Instrument

The interviews with the respondents were conducted to enable face-to-face discussions with farmers and notes taken. The interviews were both closed and open form. Closed to avoid loss of focus of the subject matter and also open to allow a very good understanding of the views and feelings the farmers have on the study variables.

Primary data.

Questionaire

Primary data was collected directly from respondents (farmers) through face-to-face interviews using multi-stage and pre-tested questionnaire. A multi-stage questionnaire was used to collect primary quantitative data from the selected cooperative members and leaders through a cooperative member survey (Questionnaire appended) to assess the extent at which fertilizers, improved seeds, extension services and Land Use Consolidation contributed to maize production during CIP. Views from all respondents were captured on the administered questionnaire.

Key Informants interviews.

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Key Informants' Interviews were also conducted.The main purpose was to complement the main instrument (questionnaire). In total, 9 In-depth Interviews (IDI) were conducted with the following groups: Nyagatare District Agriculture Officer, NGO representatives at district level (RDO&Duterimbere), Minagri Representatives at district level(RAB & RSSP),The Chairman of the Union of Cooperatives in Nyagatare, Rukomo sector Agricultural officer and the Executive secretary of Mimuri Sector. The selection of these people was based on their role in maize growing in Nyagatare or their access to data required on maize production.

Secondary Data

Secondary data was collected from Rwanda Agriculture Board (RAB), internet, published books and journals, and records of Ministry of Agriculture, Rwanda. Data was also collected on some farm records ,where they existed such as, yields, input access and distribution, agricultural practices used in farming, farmers organizational structure, level of education, access to credit, land size, family size, experience, participation in extension services, membership in cooperative ,and role of the cooperative union in supporting farmer cooperatives .

3.4. Model variables and Hypothesis testing

To get the true results of this study, Hypothesis testing was done using the Null and Alternative hypotheses. The null hypothesis is the statement or the statistical hypothesis that is actually being tested. The alternative hypothesis is the remaining outcomes of interest. The significance level is also sometimes called the size of the test and it determines the region where the null hypothesis under test will be rejected or not rejected. More specifically, a significance level of 1%, 5% and 10% was adopted in this study to explain the significance levels of different variables., The significance level used in this research is commonly known as the *p*-value. It gives the marginal significance level where the researcher would be indifferent between rejecting and not rejecting the null hypothesis (Gujarati, 2005). The *p*-value has been used in this study during the analysis of the data results to determine the significance of the data generated for interpretation and generalization.

Data Processing and analysis

Qualitative data analysis is the range of processes and procedures whereby the researcher moved from the qualitative data that were collected into some form of explanation, understanding or interpretation of the people and situations under investigation.

3.6. Regression Models

The economic model specification of the variables was:

$Y = \beta 0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_{5.....} \beta_t X_t + Ut,$

Where: : Y = Maize production (Dependent variable), $\beta 0$= Intercept;

β_1 to β_t ,are Estimated parameters, X_1, to X_t: Vectors of explanatory variables (Independent variables). Ut= Represent the error term .

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Description of Variables in the Empirical Model

VARIABLE	Description	Expected sign
Production	Total output of maize produced.	+
Sex	1 if male, 0 if female	+
Age Group	Age of respondent at the time of interview in years	-
Marital status	Whether married, single ,divorced or widowed.	+
Education background	Level of education attained	+
Family size	Number of people in the family	+
Impact of Fertilizers on maize production		+
Accesses to financial credit	Whether farmer has access to credit for agricultural activities. 1 If Yes, 0 if No	+
Goods commodity prices	Prices of maize grains on the market after harvest.	+
Farmer Incomes	Farmer incomes from agricultural activities	+
Cost of fertilizers	Cost of fertilizers on the market in Francs	-
Training	Whether farmer received training. 1 if Yes, 0 if No	+
Distribution channels	If they exist. 1 if Yes, 0 if No	+
The impact of use of improved seeds		+
Field trials	Existence of field trials: 1 if Yes, 0 if No	+
Availability of extension services	1 if Yes, 0 if No	+
Amount of rainfall	If rains were enough or not	+
Cost of seeds	Cost of improved seeds on the market	-
Output markets	Existence of output markets	+
Extension services to maize production		+
Extension to farm and beyond	Whether extension goes beyond farm to other areas in the value chain 1 for Yes ,0 for No	+
Farm size	Size of land used for growing maize measured in Ha	+
Existence of Farmer Field Schools	1 if Yes, 0 if No	+
Land Use Consolidation to maize production		
Cultivated area	Size of cultivated area	+
Cost of inputs	Whether they are expensive	-
Growing of priority crops	Whether maize is a priority crop in the area	+
Price of maize on output market	Market prices	+
Family size of land owner	Members in the family	-

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RESEARCH FINDINGS AND ANALYSIS

Introduction

This chapter highlights the research findings and assessments done to the effect on the contribution of fertilizers, improved seeds, extension services and Land use Consolidation on maize production during CIP in Nyagatare district. The findings reveal the importance of each of these variables and perceptions of farmers to their importance.

From Table 5, research results indicated that 63% of the respondents were males and 37% females. This can be attributed to the fact that majority of farmer cooperatives are headed by men and also the belief that men are traditionally considered as owners of land where agricultural activities take place from.

Respondents' identification

Table 1: Sex of Respondent.

Sex	Frequency	Percentage (%)
Male	61	63.0
Female	36	37.0
Total		100

Study findings are in line with Agri-Hub Rwanda report(2012) "Women are at least half of the workforce in agriculture; often their work is not visible, or is simply not valued, and often excluded from more profitable aspects of agri-enterprises," However, literature reviewed during this study confirms that women are just as efficient as men and would achieve the same outputs if they had equal access to productive resources and opportunities.(FAO Report; 2011) .

From the table 6,The agricultural work force gets increasing as you tend towards 45 years. However, it starts decreasing as the age tends towards 60 years and decreases significantly beyond 60 years.

Table 2: Age Group

Group	Frequency	Percentage (%)
< 30	16	16.5
31-45	50	51.5
46- 60	24	24.7
>60	7	7.2
Total	97	100

The results reveal that the majority of respondents are between the age of 31- 45 which represents 51.5% while those below the age of 30 who are normally the youth represent 16.5% of the respondents. 24.7% of the respondents represent the age group of 45-60 while only 7% of the respondents represent the age group of people with more than 60 years. This indicates the difficulty that Rwanda still faces to attract the youth into the agricultural workforce . This sector

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is still perceived by the youth as not economically viable and hence their attitude to look for employment in other sectors. The lower percentage is also indicative of the fact that below 30 years, many of the youth are still pursuing their studies.

The table 7, shows categorization of the marital status of farmers . The results show that the majority of them are married representing 82.5%.

Table 3: Marital status

Status	Frequency	Percentage (%)
Single	6	6.1
Married	80	82.5
Widow	9	9.3
Widower	2	2.1
Total %		100

It is indicative of labor distribution and sustainability of the cooperatives because of continuity agricultural activities, should one of the spouses die.

Table 8 shows the family size of the respondents. 71.1% have a family size of between 3- 5 children followed by those with less than 3 children representing 17% of the respondents while those without children and with more than 5 children are 8% and 4% respectively. Those without children were either not yet married, lost their children during genocide and newly married people.

Table 4: Family size

Size	Frequency	Percentage (%)
No child	7	7.2
Less than 3 children	17	17.5
Between 3-5 children	69	71.1
More than 5 children	4	4.1

From Table 9, majority of farmers attained primary education representing 78.4% while among the respondents, no body attained tertiary education. 15.5% have never been to school while only 6.2% had secondary education. This significantly correlates with the decline in agriculture employment rates as countries begin raising educational levels. It was realized that educated people seek employment in other sectors outside agriculture .

Table 5: Education background

Level	Frequency	Percentage (%)
Never been to school	15	15.5
Primary	76	78.4
Secondary	6	6.1
Tertiary	0	0

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This is consistent with that of Max Roser (2016) where it is stated that as countries develop their education levels, the share of the population working in agriculture is declining.
The results poses a big challenge for agricultural development in developing countries as farmers uptake of technology for agricultural innovations is still very low and thus the heavy labor intensive rather than capital intensive agricultural development.

Table 6. The impact Fertilizer use on maize production
Analysis of the relationship between fertilizer usage and Maize production

Y	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
X_1	.2776978	.0986641	2.81	0.006	.0816843	.4737113*
X_2	.2322908	.0839173	2.77	0.007	.0655745	.3990071*
X_3	.0268993	.0763935	0.35	0.726	-.1248697	.1786684
X_4	.1587814	.0979024	1.62	0.108	-.0357188	.3532816
X_5	.0775664	.0858089	0.90	0.368	-.092908	.2480408
X_6	-.1582018	.1009894	-1.57	0.121	-.3588349	.0424314
_cons	1.859117	.1832944	10.14	0.000	1.494971	2.22326

Significant at 1% (*), 5% (**), 10 % (***)
Number of obs = 97
F(6, 90) = 49.41 , Prob > F = 0.0000
R-squared = 0.7671
Y= Dependent variable
X_1 = Amount of financial credit secured
X_2= Commodity prices
X_3 = Incomes
X_4= Cost of fertilizers
X_5 = Training
X_6= Existance of Distribution channels

From the results of this study, about 77% (R-squared=0.7671) of the variation in the dependent variable, Maize production is explained by the variation in the explanatory variables incorporated in the model. The overall significance and fitness of the model can be checked with the F-Value; accordingly, Prob>F=0.000 indicates that the independent variables have statistically significant relationship with the dependent variable. According to table 10, two (2) of the explanatory variables have statistically significant relationship with the dependent variable. These are amount of financial credit secured (at 1%) and Commodity prices (at 1%). All these variables show up with the hypothesized signs. An increase in volumes of financial loans accessed of 1% increases maize production by 0.277. This is in line with the fact that , today, fertilizer trade is in the hands of private agro-dealers who need cash . It also reveals that maize prices at the end-markets influence fertilizer usage. An increase of 1% in maize prices at the end market increases maize production by 0.23.
The impact of use of improved seeds

The regression results also show that use of improved seeds has statistical significance and positive impact (P=0.000) on the level of production. From Table 11, about 95% (R-squared=0.9466) of the variation in the dependent variable ,Maize production is explained by the variation in the explanatory variables incorporated in the model.

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Table 7. Use of improved seeds

Y	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
X_1	.1934136	.0411842	4.70	0.000	.1116062	.2752211*
X_2	-.0495386	.0571218	-0.87	0.388	-.163004	.0639268
X_3	.4887747	.0768328	6.36	0.000	.3361558	.6413937*
X_4	.1162041	.0832995	1.40	0.166	-.0492601	.2816683
X_5	.4606241	.0708143	6.50	0.000	.3199602	.601288*
_cons	-.2515626	.1138202	-2.21	0.030	-.4776524	-.0254728

Significant at 1% (*), 5% (**), 10 % (***)
Number of obs= 97 F(5, 91) = 322.84
Prob > F = 0.0000 R-squared= 0.9466
Y= Dependent variable X_4= Cost of seeds
X_1 = Existence of Field trials (1=yes, 0=No) , X_5 = Existence of Output markets (1=yes, 0=No)
X_2= Availability of extension services ((1=yes, 0=No)
X_3 = Amount of rainfall

According to table 11, only three (3) of the explanatory variables have statistically significant relationship with the dependent variable. These are existence of field trials (at 1%) ,amount of rainfall (at 1%) and existence of output markets. All these variables show up with the hypothesized signs. It also reveals that maize prices at the end-markets influence improved maize seeds usage. An increase of 1% in maize prices in the output market increases maize production by 0.46 .

Field trials demonstrate the performance of different seeds under different abiotic conditions. This is significant at 1% level. Maize production is increased by 0.19 for every 1% increase in increase in number of field trials. Another parameter that influences use of improved seeds for maize production is the intensity of rainfall .This is significant at 1% level.

Analysis of Role of Extension services to maize production

From the results of this study, about 54% (R-squared=0.5400) of the variation in the dependent variable ,Maize production is explained by the variation in the explanatory variables incorporated in the model. The overall significance and fitness of the model can be checked with the F-Value; accordingly, Prob>F=0.000 indicates that the independent variables have statistically significant relationship with the dependent variable.*According to table 12, the OLS estimation indicates that extension to farm and beyond has a significant and positive relationship (P=0.002) with maize productivity (at 5%).*

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Table 8. Analysis of Role of Extension services to maize production
Analysis of the role of extension services to maize production.

Y	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
X_1	.3779898	.1175364	3.22	0.002	.1445858	.6113937**
X_2	.7030951	.0988506	7.11	0.000	.5067974	.8993928*
X_3	-.5108102	.1613718	-3.17	0.702	-.8312627	-.1903577
_cons	.3288306	.1997074	1.65	0.103	-.0677489	.72541

Significant at 1% (*), 5% (**), 10 % (***)
Number of obs = 97, F(3, 93) = 36.39
Prob > F = 0.0000, R-squared = 0.5400
Y= Dependent variable
X_1 = Extension to farm and beyond
X_2= Existence of Farmer Field Schools
X_3 = Farm Size

This could be due to extending knowledge and information to farmers beyond farm to postharvest handling ,access to finance and market linkage which is paramount for extension services (Mwikamba,2012). The other explanatory variable that has statistically significant relationship with the maize production is the existence of farmer field Schools (at 1%) . This is because Farmer Field Schools offer Practical hands-on demonstrations in the field and Training sessions on agricultural techniques as the approaches used while imparting skills to the farmers. This is in addition to the fact that 78.4% of farmers in the study area have only attended primary school level (Table 9) and therefore theoretical technological aspects become hard to grasp.

However, respondents indicated Irregularities of extensionists that in the majority of cases, the extension workers come at their own convenience not when farmers need them most. Majority of respondents interviewed deplored the absence of a functional relationship between MINAGRI and the decentralized agricultural extension services, especially at Districts, Sectors, Cell and Umudugudu (village) level as the main cause of inefficiency of extension service delivery. This research revealed that Agronomists at sector level are not only charged with agricultural activities but also other development issues like housing, plot demarcations and construction permits. They function as generalists, irrespective of their training background . In addition, their line of duty falls under ministry of local government and not Ministry of Agriculture. This leaves most of the extension work in the hands of the NGOs.

Analysing the contribution of Land Use Consolidation to maize production
From the results of this study, about 80% (R-squared=0.8027) of the variation in the dependent variable ,Maize production is explained by the variation in the explanatory variables incorporated in the model. The overall significance and fitness of the model can be checked with

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the F-Value; accordingly, Prob>F=0.000 indicates that the independent variables have statistically significant relationship with the dependent variable.

According to table 13, two (2) of the explanatory variables have statistically significant relationship with the dependent variable. These are Size of cultivated area (at 5%) and Prices of maize on the output market (at 1%).

The coefficients of all the variables that are not statistically significant have the expected sign. However, results from this study reveals that 76.3% of respondents say that land use consolidation contributed less than 50% of maize yields in their localities. This could be attributed to other external factors other than CIP. Namely: Agriculture activities are still rain fed even where irrigation infrastructure were installed as they are not fully functional.; There is limited data available to assist in making comparisons before and after introduction of land use consolidation policy as there no records available, hence limited justification of data generated in the present study

Table 9. results on contribution of Land Use Consolidation to maize production

Y	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
X_1	.2413586	.0985846	2.45	0.016	.0455324	.4371848**
X_2	.1025161	.0919831	1.11	0.268	-.080197	.2852293
X_3	-.0513433	.0854051	-0.60	0.549	-.22099	.1183035
X_4	.4026457	.0613632	6.56	0.000	.2807553	.524536*
X_5	-.0040017	.0705001	-0.06	0.955	-.1440415	.1360381
_cons	.6750071	.1178211	5.73	0.000	.44097	.9090441

Significant at 1% (*), 5% (**), Number of obs = 97
F(5, 91) = 74.03 Prob > F = 0.0000
R-squared = 0.8027
Y= Dependent variable X_4= Prices of maize on the output market
X_1 = Size of cultivated area X_5 = Family size of land owner
X_2= Cost of inputs
X_3 = Growing of priority crops

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

This study was conducted in Nyagatare district located in the Eastern Province of Rwanda. Its objective was to analyze the contribution of the Crop Intensification program (CIP) on maize production in Rwanda with focus on Nyagatare district . Improved seeds, Inorganic fertilizers, Extension services and Land Use Consolidation were the major variables for consideration in this study and assessment was made as to the contribution they made to maize production in CIP in the study area . The study focused on 24 cooperatives with 97 respondents. It used qualitative approaches to generate the opinion of respondents where data was not readily available and also quantitative methods where both primary and secondary data could be generated easily. Primary

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data was collected using questionnaires from random sample of 97 farmers, and it considered the socio-economic characteristics of farmers while Secondary data was collected from different sources, e.g., Ministry of Agriculture, District offices, Agriculture Sector working Group (ASWG) reports , books, reports and internet...etc. The research used correlation and regression techniques together with the Statistical Package for Social Science (SPSS) and STATA to analyze and interpret data finding of the model The economic model specification of the variables was:$Y = \beta 0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_{5.....} \beta_t X_t + Ut$,
Where: Y = Maize production (Dependent variable), $\beta 0$= Intercept; β_1 to β_t ,are Estimated parameters, X_1, to X_t: Vectors of explanatory variables (Independent variables). Ut= Represent the error term .

Research findings revealed that; youth and educated people's engagement in agricultural activities is minimal; Men constitute a bigger proportion of the agriculture work force than women creating a gender gap in the sector; Extension services has not influenced maize production significantly as 54% (R-squared=0.5400) of the variation in the dependent variable ,Maize production is explained by the variation in the explanatory variables incorporated in the model. Improved seeds influence significantly maize production more than other independent variables in this study as it has statistically significant relationship with the dependent variable (R-squared=0.94700) That of the 4 variables under study, improved seeds have more influence on maize production than others .

Conclusion.
Fertilizer uptake and usage when used in appropriate proportions enhance maize production yet the government has been keen in promoting mineral fertilizer use in equal dosages all over the country ignoring soil nutrient requirement levels and environmental management strategies for boosting soil strategies.

It has been realized that rainfall intensity in the planting season is important for maize productivity as it helps cope with harsh conditions, existence of the field trials and output markets for the maize are very important factors that influence maize production as they act as incentives for farmers to increase production.

Knowledge and skills are a crucial factor to ensure that farmers are able to produce the right quantities and quality required by the market. However, approaches used in imparting knowledge and the attitude of farmers are crucial factors for consideration.Level of trust of neighbors and land topography are crucial elements for consideration while planning land use consolidation without ignoring farmers' perceptions and attitudes.

Recommendation
The inputs distribution system should be improved upon to deliver seeds and fertilizers in time and reduce possibilities for damages which results into reduced yield potentials. There should be soil testing to assess soil nutrient requirements in the soils before application of fertilizers. However, Government should put in place mechanisms to ensure fertilizers are affordable and accessible. Efforts should also be made to generate hybrid seeds produced locally and adoptable

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to local environment. This should be supported by research to generate resistant and better yielding maize varieties as they have high potential to increase maize production. This would increase maize productivity and production in the short run.

To create and reinforce a functional relationship between MINAGRI and extension workers at District and Sector level. Knowledge and skills are a crucial factor to ensure that farmers are able to produce the right quantities and quality required by the market. Therefore, MINAGRI has a huge role to play to ensure that frontline extension workers have the capacity and skills to provide the right knowledge and advice to the farmers and producer groups being served. There is also need to harmonize and coordinate extension activities from local government, MINAGRI and other service providers. Research results to be effectively translated into extension messages and disseminated to different beneficiaries and partners.

Need for introduction of high-value crop on consolidated plots as an incentive to make Land consolidation economically viable. There has never been an attempt to measure the land that has been consolidated each year to get data for this variable. There should be deliberate effort by the Government to use scientific ways of measuring out land plots that have been consolidated.

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