Yield performance and farmers' responses to corn composite varieties in Pandeglang Regency, Banten Province

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Abstract. The objective of the present study was to determine yield performance and farmers' preference to the Lamuru composite corn variety planted with the application of corn Integrated Crop Management (ICM) and non Integrated Crop Management (non-ICM). The study was conducted in Kadumadang Village of Pandeglang Regency on a dry land agro-ecosystem in February-May 2020. The composite corn variety used was the Lamuru variety. Data was gathered using direct observation of agronomic performance and production with 10 replications. The agronomic data observed were plant height, number of leaves, stem diameter, 50% flowering age, cob length, cob diameter, number of rows per cob, 100 grains weight, stover weight, cob weight and dry seeds weight. Interviews and questionnaires were conducted to determine farmers' preference to the Lamuru variety performance. Quantitative data was analyzed statistically and qualitative data was analyzed descriptively. From the result, the growth of corn ICM was higher than non-ICM. It resulted in a higher productivity of corn ICM (9.27 t/ha) compared to non-ICM (6.68 t/ha) significantly. Furthermore, farmers gave a fairly high response to the performance of Lamuru variety through the application of corn ICM and non-ICM, respectively at 79.95% and 72.52%.

1 Introduction

Corn is the strategic commodity after rice because corn is one type sereal that has economic value. A part from being foal and feed, corn is also widely used asaenergy row material and other industrial raw materials whose nedds are increasing every year [1]. To provide the hybrid corn seed provision, commonly farmes in Banten province are still relying on the Government seed assistance program. Constraints in developing corn independently are due to the high price of hybrid corn seeds. Moreover, hybrid corn seeds are not recommended for being use as seeds in subsequent plantings. In this case, it can only be planted once. This

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situation causes low purchasing power of farmers. To overcome the problem, one solution is to use free pollinated (composite) corn seeds. Some of the advantages of composite corn include: mature early, seeds are easy to be propagated by farmers so that it is possible to spread quickly, reduce farmers' dependence on other parties because they can save their own seeds, and lower production costs [2]. The ease of obtaining quality seeds is needed by farmers to increase their corn production. High-yielding composite corn has wide adaptability, can be developed on marginal land and fertile land, seed prices are relatively cheap, early maturity and yields are high enough, seeds can be used for several generations without experiencing yield degeneration [3]. Furthermore, the planting of high-yielding composite varieties in accordance with agroecological conditions increase yields up to 42.3-49.8% compared to local varieties [4-5]. The Lamuru composite corn variety released in 2000 was moderately resistant to downy mildew and also drought tolerant so that maize could be grown in dry land [6]. Therefore, the introduction of composite corn varieties can be an alternative for farmers in developing corn.

One component of composite corn Integrated Crop Management (ICM) that plays a role in increasing production is the use of quality seeds and high-yielding varieties in accordance with the conditions of the development area. The application of composite corn ICM, namely the use of superior varieties and the application of fertilizer according to recommendations, can affect the increase in corn productivity [7-8]. Superior varieties are one of the innovative technologies to increase plant productivity through increasing plant potential (yield) and tolerance to various biotic and abiotic environmental stresses. One of the composite corn varieties that can be developed in dry land is the Lamuru variety.

The objective of the present study was to determine yield performance and farmers' preference to the Lamuru composite corn variety planted with the application of corn Integrated Crop Management (ICM) and non Integrated Crop Management (non-ICM).

2 Materials and methods

2.1 Research site and materials

The study was carried out in Kadumandang Village, Cimanuk District, Pandeglang Regency on dry land agro-ecosystems in February-May 2020. Activities involve farmers as the implementers.

2.2. Design experiments and data analysis

There were two treatments compared, namely (A) corn cultivation with the application of corn Integrated Crop Management (ICM) [9] and (B) corn cultivation that did not apply corn Integrated Crop Management (non-ICM), each were conducted with 10 replications. The size of the treatment plot was 100 m^2. Corn cultivation management is listed in Table 1.

2.2.1. Corn agronomic and yield components

The agronomic data and yield components observed were: 1) plant height, number of leaves, stem diameter at the age of 30, 60, 90 days after planting; 2) 50% flowering age, 3) cob lenght (cm), 4) cob diameter (mm), 5) number of rows per cob, 6) 100 grains weight (g), 7) stover weight (t ha^{-1}), 8) cob weight (t ha^{-1}), 9) dry seed weight (t ha^{-1}). Yield per plot was weighed tile (2.5 m x 2.5 m), then converted to hectares. The agronomic data were analyzed using a T-Test in order to know the independent variable which has a significant effect on the dependent variable partially. The data collected were analyzed using the Statistical Package for Social Science (SPSS) version 20.

Table 1. The corn ICM and non-ICM technology components

Technology components	Corn Integrated Crop Management (ICM)	Corn Non Integrated Crop Management (non-ICM)
Land Preparation	Simple tillage	Simple tillage
Seeds/Varieties	the Lamuru composite corn variety	the Lamuru composite corn variety
Seed treatment	Fungcide Ridomil (2 gram per kg of seed)	-
Fertilizing Dosage	Recommendation (Urea 350 kg ha^{-1} + SP-36 100 kg ha^{-1} + KCl 50 kg ha^{-1})	Urea 100 kg ha^{-1}, NPK Phonska 200 kg ha^{-1}
Non organic fertilizer application	SP-36 fertilizer is given at the same time at the age of 7-10 DAP Urea and KCl fertilizers were given twice at the age of 7-10 DAP and 25-30 DAP. Fertilizer is given by placing it beside the plant at a distance of 10 cm from the plant	Fertilizer is given 1-2 times. The first fertilization is 10-30 DAP, the second fertilization at the age of 35-50 DAP.
Organic fertilizer application	3 t ha^{-1} applied at planting time to cover the planting hole	1 t ha^{-1}
Spacing	75 cm x 40 cm with 2 seeds per hole. Making drainage channels to regulate the entry and exit of water to irrigate corn plants according to plant needs	70 x 20 cm
Hoarding	Performed 2 times simultaneously with the second weeding age 25-30 days. Mechanical weed control 2 times: 10-15 DAP and 25-30 DAP	More than 50% are not hoard
Pest control	Chemical pesticides based on pest monitoring results and the 6 rules (type, target, dose/concentration, time, method, quality)	Chemical pesticides based on population but have not met the correct 6 rules in choosing the type of pesticide, dose and method of application.
Harvesting	Physiological ripening is indicated by the presence of a black layer as much as 50% of the corn kernels.	Harvest when conditions are not physiologically ripe

2.2.2. Farmer Preference

The measurement of farmer response was carried out by looking at the level of farmer's preference for the performance of the Lamuru composite corn variety included general plant performance and yield components. The number of respondents were 30 people. Data were gathered through interviews and filling out questionnaires through direct observation of plant performance and assessment of each question variable in the questionnaire form. Perceptual data taken on the Lamuru composite corn variety included: 1) plant height, 2) growth uniformity, 3) resistance to pests and diseases, 4) cob shape and size, 5) number of cobs, 6) plant appearance, 7) seeds can be replanted, and 8) cheaper seed prices. Furthermore, the results are tabulated, analyzed descriptively and presented in percentage form [10].

3 Results and discussion

3.1 Corn Growth Performance

Vegetative growth in the application of corn ICM showed higher result than non-ICM (Table 2). This condition is due to the sufficient N element to support optimal vegetative growth. The same result were reported by [11] that the application of organic fertilizers and inorganic fertilizers can increase photosynthetic activity in leaves which ultimately results in optimal plant vegetative growth. Corn plant growth is not only influenced by nutrient factors but also by genetic composition. The genetic composition will be expressed in a growth phase. In this case, it is expressed in various plant traits which include the form and function of the plant that results in the diversity of plant growth. Plant height, number of leaves and stem diameter in non-ICM compared to ICM were lower. It is suspected that the dose of non-ICM fertilization is less, so that vegetative growth is less than optimal. Provision of nutrients that are not in accordance with plant needs will cause loss of N in the soil, growth is not optimal which ultimately causes low efficiency of N use [12].

Table 2. Growth of Corn Plants

Variables	Corn Integrated Crop Management (ICM)	Corn Non Integrated Crop Management (non-ICM)
Plant height (cm)		
30 DAP	116.05^{a}	78.43^{b}
60 DAP	198.45^{a}	169.57^{b}
90 DAP	213.69^{a}	201.57^{b}
Leaves number		
30 DAP	9.67^{a}	7.67^{b}
60 DAP	12.46^{a}	13.07^{a}
90 DAP	14.47^{a}	14.40^{a}
Stem diameter (mm)		
30 DAP	14.91^{a}	10.21^{b}
60 DAP	19.50^{a}	19.34^{a}
90 DAP	20.43^{a}	20.24^{a}

^{a,b}: The same number in the same row is not significantly different in the T-Test with a level difference of 0.05

In the application of corn ICM, male and female flowers appear faster than non-ICM. Based on the observations, the flowering age of males and females in the application of corn ICM was 56 days and 60 days, respectively. Furthermore, the flowering age of males and females in the application of non-ICM was 59 days and 64 days. According to [3], the rate of female flowers formation greatly determines the generative phase of corn plants. The flowering age of corn plants is more dominantly determined by genetic and environmental factors or the interaction between these two factors. According to [7], a small 50% age interval between male and female flowering plants can increase production because the pollination process can take place optimally.

3.2. Performance of Corn Yield Components and Productivity

Yield components of the length of the cob, diameter of the cob, number of rows of seeds per cob, weight of 100 seeds, and dry shelled seeds are yield component variables that determine maize yield per hectare. Observations on the yield components of Lamuru variety on ICM and non ICM application are shown in the Table 3.

Table 3. Performance of Corn Yield Components and Productivity

Parameter	**Corn Integrated Crop Management (ICM)**	**Corn Non Integrated Crop Management (non-ICM)**
Cob length (cm)	17.7^a	15.89^b
Cob diameter (mm)	47.92^a	43.68^b
Number of rows per cob	14.81^a	13.57^b
100 grains weight (g)	31.27^a	25.29^b
Stover weight (t ha^{-1})	24.47^a	23.58^a
Cob weight (t ha^{-1})	13.68^a	11.38^b
Dry seed weight (t ha^{-1})	9.27^a	6.68^b

^{a,b} : The same number in the same row is not significantly different in the T-Test with a level difference of 0.05

The weight of 100 grains in the ICM (31.27 grams) is higher than the non-ICM (25.29 grams). Moreover, the weight amount is higher compared to the description of the 100 grains weight Lamuru variety which only reaches ± 27.5 grams. Regarding the corn yield performance, the weight of 100 grains is a determining factor for the results obtained. Based on observations of seed weight, the Lamuru variety has the potential and can be an alternative for corn production development.

The yield components such as cob length, cob diameter, number of rows per cob, weight of 100 grains, and dry seeds weight are yield component variables that can determine corn yield per unit area. The yield components for the application of corn ICM are higher than the non-ICM, so that it affects productivity per ha (Table 3). This means that the cultivation of composite corn in dryland gives a positive response to corn yields when given a combination of organic fertilizers and inorganic fertilizers. In this experiment, it was shown that the use ICM in dry land had a positive effect on increasing Lamuru composite maize yields. Corn productivity by applying the corn ICM is higher than the non-ICM, namely 9.27 t ha^{-1} and 6.68 t ha^{-1}. This is in line with the results of the study on the application of corn ICM which shows that the application of corn ICM using composite corn varieties in dry land can reach optimum production. In this case, the composite corn varieties can reach maximum yields if the nutrients needed by plants are fulfilled. High yields in a sustainable manner can be achieved if NPK fertilization is combined with the use of organic matter in ICM treatment. In other words, an appropriate dry land management strategy that combined the use of of organic and inorganic fertilizers will result in an increase of soil productivity, so it will increase the crop yields. The grain yield of corn is affected due to different factors like varieties, weather stress, biotic stresses, soil fertility and characteristics as well as management decisions during crop growth and these directly or indirectly may lower the yields [12-13].

Site-specific nutrient management can provide nutrients for plants in the right amount, type, and time of application, taking into account plant needs and land capacity in providing nutrients for plants. Plant growth, yield components and better corn yields in superior varieties caused by genetic factors, thus the plant physiological process will increase [14-15].

Inorganic and organic fertilizers in the ICM treatment contain elements of N, P and K which can provide optimal growth and production of corn plants. In the Non-ICM treatment, the elements N, P and K are less supportive of composite corn plants. Balanced nutrients of nitrogen (N), phosphorus (P), and K (potassium) are needed for the optimal growth of corn plants. Deficiency of these nutrients often occurs in the soil so that it requires additional fertilizers, both organic fertilizers and inorganic fertilizers [16]. The same results were also reported that organic and inorganic fertilization simultaneously increase the growth and yield of maize [11]. The results of other studies also reported that the application of NPK fertilizers and biological fertilizers in soybean cultivation provide a positive response growth and yields [17].

3.3. Farmer Preferences on Lamuru Variety Performance

Table 4. Respondent Characteristics in the Present Study

Age (year)	Proportion (%)	Educational background	Proportion (%)	Land area (ha)	Proportion (%)
< 20	1.40	Elementary School	51.61	< 1	14.81
20-30	11.42	Junior High School	16.13	1-2	81.48
31-40	36.24	Senior High School	32.26	3-5	3.71
41-50	33.19		-	> 5	-
50-60	16.24				
> 60	1.51				

The respondent farmers came from 4 farmer groups around the study location, almost 80% were farmers at a very productive age with almost 50% education level in junior high and senior high school (Table 4). This is a fairly good asset as an agent for disseminating information in their respective areas. Productive age with a relatively high level of education allows farmers to be more dynamic and more receptive to new innovations. The farmers' preferance to Lamuru corn variety can be seen in Table 5.

Table 5. The farmers' preference on Lamuru corn variety using ICM and non-ICM

Parameter	Integrated Crop Management (ICM)	Non Integrated Crop Management (non-ICM)
	(%)	
Plant height	80.1	70.5
Growth uniformity	76.1	69.6
Resistance to pests and diseases	80.1	65.8
Cob shape and size	75.8	70.6
Number of cobs	79.5	70.2
Plant appearance	78.6	71.5
Seeds can be replanted	88.9	81.5
Cheaper seed prices (compared with the hybrid corn seed)	80.5	80.5
Average	79.95	72.52

Based on Table 5, it can be seen that the farmers' preference for Lamuru variety with the application of corn ICM is quite high, where the average response of farmers is 79.95% while non-PTT maize is 72.52%. Furthermore, the parameter of Lamuru composite corn seed that can be replanted is the highest response given by farmers. This shows that the Lamuru composite corn variety has the opportunity to be developed independently by farmers. This is in line with the result study of [8] that adoption of corn production technology with the ICM approach increase farmers' productivity and income. The same result of the application of ICM for paddy productivity which was reported by [18].

4 Conclusions

Corn cultivation with the application of corn ICM provides better growth and productivity. The response of farmers to Lamuru composite corn variety is quite good, this condition provides an opportunity to develop Lamuru composite corn variety independently at the farmer level.

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