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Factors Influencing Adoption Index of Double Row System in Planting Hybrid Corn on Dry Land in Pringgabaya District, East Lombok Regency, West Nusa Tenggara

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Abstract : *This study aimed to determine the factors influencing adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency, west Nusa Tenggara. This study was done in survey method; interviewing some respondents. Number of respondents was determined by using Slovin Formula, and it was generated 73 respondents. The respondents were randomly selected from the population of corn farmers in the study sites. The data were analyzed using multiple linear regressions. The analysis result shows that duration of formal education (X1), cultivated land area (X2), seed price (X3), fertilizer price (X4) and attendance intensity in counseling (X5) simultaneously give significant effect (p-value <0,05) on the adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency, west Nusa Tenggara. Furthermore, the partial test shows that the formal education (p-value <0.10), the price of seed (p-value <0.15) and intensity in counseling (p-value <0.15) gave significant effect on the adoption index of the double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency, west Nusa Tenggara, while the others (area of cultivated land (p-value> 0.15) and fertilizer price (p-value> 0.15)) did not.*

Keywords*: corn, double row system, index, adoption, innovation*

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I. Introduction

Corn (Zea mays L) is a commodity that has an important and strategic role in national development. Nowadays, corn is used not only as food but also as a feed ingredient and industry. In addition, some countries have started to use corn as alternative fuel (*biofuel*). Corn demand continuously increases in proportion to the population growth, as a result of increase of food demand, consumption of animal protein and energy.

Most of the fulfillment of animal protein consumption comes from chicken meat. In this case, corn is the main raw material of animal feed, and determines the sustainability of national meat production. In recent years, the proportion of maize use in the feed industry has reached 50% of the total national demand, and in the next 20 years, the use of maize for feed is expected to continuously increase, even after 2020s, the corn use for feed is more than 60% of the total national needs (Kementan, 2015).

Regarding to the important functions and roles of the maize, the Government has done some efforts to realize the self-sufficiency of maize, one of which is increasing the index of crops and plant population. Self-sufficiency of corn means that domestic production is able to fulfill food needs, raw materials of animal feed industry and other industry (*biofuel*). To achieve this, corn production is set to increase by 5% per year (Sembiring, 2015).

In order to meet the needs of the maize by increasing the index of crops and plant population, it is required technology or innovations which are appropriate for agrosystem, agro-climatic and local community. One of the innovations (technology) is the double row system.

The system of double row is a result of research and study, but it is not yet widely by farmers caused by several factors, both internal factors and external factors. This is in accordance with the research of Bulu (2009), which shows that corn planting innovation has been widely generated from research and study, but it has not been widely used by farmers due to the information about the innovation is spread slowly.

Adoption of double row system in East Lombok is still in low rate. It can be seen from the data released in 2016 showing that the system is adopted only in 32.95% (16,537.71 Ha) of total planting area; 26.863 Ha (BP4K East Lombok, 2016).

The low adoption rate of double row system is also caused by lack of knowledge, skills, attitude of farmers as the main actors and business actors of hybrid corn. This can be examined by an assessment to farmers.

Based on the description, the problems in this research can be formulated as follows: What are the factors influencing index of adoption of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency, west Nusa Tenggara?

The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.

II. Research Methodology

This study was conducted in descriptive method. The location of the research was determined by *purposive sampling* method. The location determined were North Pringgabaya Village, Labuhan Lombok, and Gunung Malang with the consideration that the farmer groups in the three villages are trying to plant the corn on dry land. Sample size in this study was determined by *Slovin formula* (Umar, 2000), generating 73 people spread in four farmer groups in four Villages.

Types and Data Sources

Type of data in this study is qualitative and quantitative data; qualitative data are data obtained not in the number form, and in the opposite, quantitative data are data in the number form. Data sources are primary data and secondary data.

Data analysis technique

The main factors or components that influence the adoption index were analyzed using *Principal Component Analysis* (PCA). While estimation model of determinant factors were analyzed using *Multiple Linear Regression*.

III. Results And Discussion

Pringgabaya is one of sub-districts in East Lombok regency of West Nusa Tenggara Province with an area of about 136.20 km^2 and a population of about 93.980 people, spread over 15 (fifteen) villages. While the number of rainy days and rainfall indicate that the rainy season is evenly distributed throughout the year starting around November with an average rainfall of 76.9 mm. The highest rainfall is in March, reaching 182 mm. Most rainy days occurred in March for 15 days and the smallest rainy day in October for 1 day (BPS East Lombok).

Results and Discussion

The dependent variable is adoption index score of the system, which shows that 51 respondents (71.1%) have adoption index score above 100, categorized high rate adoption, while 22 respondents (28,9%) have adoption index score below the 100, categorized low adoption rate.

The independent variables in the dataset, after the reduction by using PCA method, were obtained 5 (five) new variables that affect the adoption index. The five new variables are able to explain the total variance (cumulative percent of variance) of 83.019%. This means that the adoption index can be explained only with 5 (five) variables. The variables are education, cultivated land area, seed price, fertilizer price and attendance intensity in counseling. These five variables are factors that influence adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency, west Nusa Tenggara.

Furthermore, it was done further analysis to know the effect of independent variables on dependent variable using *Multiple Linear Regression* model, with result as follows:

Table 4.1 Result table of *Multiple Linear Regression.*

Variables	Coefficient	Standar error	T-Value	P-value
(Constant)	10,404	0,134	77,793	0.000
Education (X1)	0,357	0,138	2,577	0.062
Land Area (X2)	-0,056	0,083	-0,681	0.533
Seed's price (X3)	0,133	0,074	1,799	0.146
Fertilizer price (X4)	-0,077	0,213	-0,362	0.736
Attendance intensity (X5)	0,128	0,062	2,049	0.110

Source: research result, 2017.

According to the table 4.1, it can be generated the estimation model of the Adoption Index (AI) as follows:
AI= 10,404 + 0,357X1 – 0,056X2 + 0,133X3 – 0,077X4 + 0,128X5.

The estimation model above shows that the constant value is 10,404. This means that without increase of formal education, the area of cultivated land, the price of seed, the price of fertilizer and the intensity of attendance in counseling, the adoption index is an average of 10,404 percent.

The formal education coefficient of 0.357 means that if the duration of formal education increases 1 year, the adoption index increases by 3.57 percent, in the assumption that other variables remain. Furthermore,

the coefficient of cultivated land area is -0.056, which means that the addition 1 are (0.01 ha) of cultivated land area would reduce the adoption index by 0.56 percent, in the assumption that the other variables remain. Similarly, the price of seeds have a coefficient of 0.133, which means that if the price of seeds rises 100 rupiah per kilogram, it would increase the adoption index by 1.33 percent, in the assumption that other variables remain. The fertilizer price coefficient is -0.077, meaning that the rise of fertilizer price of 100 rupiah per kilogram would decrease the adoption index by 0.77 percent, in the assumption that other variables remain. Similarly, the coefficient of attendance intensity in counseling is 0.128, meaning that increase of intensity of presence in counseling as much as 1 time would raise the adoption index by 1,28 percent, in assumption that other variables remain.

Goodness of Fit test (R^2 test) shows that the R-Square value is 0.929. This means the independent variables (duration of formal education, land area, seed price, fertilizer price and intensity of presence in counseling) bound the adoption index of 92.9%. While the rest of 7.1% is explained by other variables did not included in this research model.

Table 4.2 Test of Goodness of Fit Research Model.

R	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*
0.964[a]	0.929	0.841	0.09837

Source: research result, 2017.

Determinant factors of Adoption

Based on the estimation result shown in Table 4.1 shows the duration of formal education (X1) has a significant effect (p-value <0.10) on the adoption of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency, west Nusa Tenggara.
The higher formal education of farmers or higher education has a higher adoption index. The coefficient of variables is positive, giving meaning that if the farmer's education increases, the adoption index of corn farmers will increase in line with the increase of formal education. This is caused by the adoption of technology is strongly influenced by the perception of farmers on the technology. The formation of one's perception is greatly influenced by the level of formal education (Aswanto 2002 and Stoner and Freeman, 1989 in Sudjarmoko, 2009). Furthermore, Sudjarmoko (2009) stated that the increase of farmer education would open up opportunities to get side jobs that provide better income, so that a good income can support the rise of adoption index. In opposite, farmers with lower education only have the opportunity to get side job providing lower income, for example being farm laborers or fishermen.

On the other hand, the level of education has a strategic role in the adoption of an innovation. For example, in the adoption of an innovation (technology), it is started by a deliberation; according to the tradition of *sasak* tribe, the deliberation is often called *sangkep* (Karyadi 2013). The deliberation is usually led by people with higher education level, because they are believed more communicative. In addition, it can also be seen on the deliberation for various family activities, often called *begundem*. Furthermore, Karyadi (2013) explained that *sangkep* refers to formal deliberations and aspects discussed more widely compared to the *begundem*, which is small and not formal deliberation (usually between families or small limited groups).

Education has a significant effect because it can give the community an ability to read and understand about the technological innovation of the double row system both from leaflets (posters, brochures, pamphlets) and technological information (Whatsapp, twitter, facebook, LINE). Improvement of the education level in the research sites is one of the social impacts of migrant workers (TKI) to Malaysia. The impact has been explained by Karyadi (2013), the improvement of education of family members is supported by the other family members who become migrant workers in Malaysia. Members of the family who can continue their education to a higher level would certainly be a dissemination agent of the innovation both in his family and the surrounding community.

Furthermore, Soekartawi (2005) claimed that education is a tool to improve the skills and knowledge of new agricultural technology. Many researchers support this statement, for example Chaundhri (1997) in Soekartawi (2005), he stated that education is a learning tool, which is in the future could instill a sense of favorable attitudes toward the use of more modern agricultural practices. Out of this case, education may simply create a boost to an understanding that profitable innovations are able to create.

One of the factors which determines the adoption of innovation is education, it is in line with the opinion of Bulu, et al (2009); one of the factors which also determines adoption of a system is *human capital*, including knowledge (education), motivation and attitude to innovation. The concept of *human capital* views human beings as autonomous individuals in which knowledge, motivation and attitudes are related to the adoption of innovation system as a mental process.

Furthermore, the variable of cultivated land area (X2) has no significant effect (p-value> 0.15) on the index of adoption rate. The coefficient of variables is negative, giving meaning that if the area of cultivated land increases, the index of the adoption rate would decrease. In line with Prabayanti (2010), the area of cultivated land does not give a significant effect in determining the adoption of *biopesticide* in Mojogedang sub-district, Karanganyar Regency.

The seed price (X3) give a significant effect (p-value <0.15) on the adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency, west Nusa Tenggara. The coefficient of variable is positive, meaning that if seed price rises, the adoption index of the system would increase. This is related to the interest of farmers to new varieties or brands of seeds. For example, when BISI-16 and PIONER brands are released, the old varieties or brands of composite corn would be abandoned even though the new variety or brand is more expensive. This is caused by the farmers believe (by only looking at the description of the new superior seeds) that the new superior seed would give real benefits to them. This is in accordance with the character of innovation; innovation must give real benefits to farmers (Musyafak, et al 2005). An increase of the price of seeds would surely increase production costs, and it is followed by increase of the adoption rate index. This is in line with research conducted by Hendayana, et al (1996), that opportunities to continue the tabela system tend to increase in line with increase of planting and maintenance costs (wage labor); the result of analysis indicate that the variables of planting and maintenance cost are positive and gave a very statistically significant effect ($\alpha = 0,01$).

Variable of fertilizer price (X4) did not gave significant effect (p-value> 0,15) on the adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency. The coefficient of variable is negative, meaning that if fertilizer price increase, adoption rate index would decrease along with increase of fertilizer price. This is related to the recommendation package of double row system on dry land which is quite high ; about 250 kg/ha Urea + 250 kg/ha Phonska or about 300 kg/ha Urea + 200 kg/ha Phonska (recommendation from BPTP NTB, 2016). Related to the recommendation, the price of the fertilizer is adequate expensive to farmers (Rp. 2.400/kg for Urea and 2.400/kg for Phonska). On the other hand, the price is much more than the highest price determined by the government (HET) of Rp. 1.800/kg for Urea and 2.300/kg for Phonska. The high price of fertilizer (over HET) certainly decreases the adoption index. This is in accordance with the nature of innovation which must be affordable for the farmers. This is also supported by the results of Musyafak's study, et al (2005), indicating that one of the adoption constraints is the expense of an innovations/technology (the case of concentrate feed technology for cattle in Sanggau Ledo).in addition, Musyafak et al (2005) said that even any technology is really good enough, if it is not affordable for farmers as a user, it is difficult to adopt. Moreover, most farmers are poor, so the cheaper innovation would be adopted faster than expensive innovation.

The intensity of attendance in counseling (X5) has significant effect (p-value <0.15) on the adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency. The coefficient of the variable is positive, meaning that if the intensity of attendance in counseling increases, the adoption index rate would increase along with increase of the attendance intensity in counseling. Presence in counseling is essential in improving knowledge, skills and attitudes and is highly influential on a technology adoption. This is in accordance with the results of Harinta's research (2010); participation rate among farmer's families, interpersonal communication and activeness in seeking information about innovation have a significant effect (p-value <0.01) on the rapidity of adoption of agricultural innovation. Mardikanto (1996) in Harinta (2010) also states that community members who like to join outside community are generally more innovative than those who do not. People who actively seek new information and ideas are more innovative than passive people, who are always skeptical about something new. The presence in the counseling greatly influences the adoption index, because at the time of counseling, farmers can ask about the innovation of the double row system. Adam (1998) in Musyafak, et al, (2005) also states that counseling to any farming group has some advantages, i.e: (1) the farmer can be active, (2) feedback can be obtained directly to the specific problems faced by community and (3) final result is the agreement of various parties.

The simultaneous test shows that the duration of formal education (X1), the cultivated land area (X2), the price of seed (X3), the price of fertilizer (X4) and the intensity of attendance in counseling (X5) simultaneously give a significant effect (p-value <0,05) on adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency.

IV. Conclusions And Recommendations

Based on the results of research, it can be concluded that the determinant factors which affect the adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency, as follows:

1. The simultaneous test shows that the duration of formal education (X1), the cultivated land area (X2), the price of seed (X3), the price of fertilizer (X4) and the intensity of attendance in counseling (X5) simultaneously give a significant effect (p-value <0,05) on adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency.
2. The partial test shows that duration of formal education (X1), seed price (X3), and intensity of attendance in counseling (X5) gave a significant effect (p-value <0,15) on adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency. While the two other variables cultivated land area (X2) and fertilizer price (X4)) did not significantly influence (p-value> 0.15) the adoption index of double row system in planting hybrid corn on dry land in Pringgabaya district, East Lombok regency.
3. Based on the results of this study, it is recommend that the deployment of the innovation should be appropriate to the characteristics of farmers and the environment so that it can be adopted rapidly. Some efforts that can be done to boost the farmer in adopting the system are establishing a pilot land around the farmers' land, training, providing accessible information and other supporting facilities to increase production and the income and increasing welfare of farmers.

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