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## Comparative Analysis of Granola and Atlantic Potato Farming in Magetan Regency

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### Abstract

#### **Keywords:**

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Analysis;  
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Potato is one of the vegetable commodities that are utilized by its tubers and have the potential to be developed, as is the case in Magetan Regency. This study aimed to analyze the costs, revenues, productivity, income, profits, efficiency, and profitability, as well as to compare the potato farming of Granola and Atlantic varieties. Location determination was done purposively with 100 respondents. The data used was quantitative data and the data collection techniques were observation, interviews, and documentation. The data were analyzed using Z distribution statistical tests at 95% confidence level ( $\alpha$  0.05). The results showed that the amount of granola potato farming costs was IDR 99,103,163 / ha / MT, revenue of IDR 158,310,720 / ha / MT, productivity of 22,590 kg / ha, income of IDR 101,857,730 / ha / MT, profit of Rp 59,207. 557 / ha / MT, efficiency 1.60 and profitability 0.60. While the cost of atlantic variety potato farming is IDR 97,332,514 / ha / MT, revenue is IDR 130,464,460 / ha / MT, productivity is 18,718 kg / ha, income is IDR 74,530,033 / ha / MT, profit is IDR 33,141,946 / ha / MT, efficiency 1.34 and profitability 0.34. There are differences in productivity, income, profits, efficiency, and profitability between the granola and atlantic varieties of potato farming. This research is expected to be an input for farmers to maximize the care of their farms so as to increase productivity, income, and profits of farmers.

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## INTRODUCTION

Agriculture is one of the sectors that play an important role in the development of the Indonesian economy. The agricultural sector is not only a food provider but also a source of livelihood for the Indonesian population, because most of the population depends on this sector. Indonesia, as a tropical country, has considerable potential to develop horticultural commodities. The development of the horticulture sub-sector in Indonesia is being driven towards the agribusiness system because of its abundant natural resource wealth and aims to increase income for the farmers to be achieved through increased production and productivity of their farming (Dewi et al., 2016).

Potato is one of the horticultural commodities which produce tubers for consumption; both used as a vegetable and processed food product industry. Potato tubers have a lot of nutritional content and are the main source of carbohydrate. Every 100 grams of potato tubers contains 85.6 g carbohydrates, 347 cal calories, 0.3 g protein, 0.1 g fat, 20 mg calcium, 30 mg phosphorus, 0.5 mg iron, and 0.04 mg B vitamins (Gunarto, 2013; Samadi, 2007). The consumption of potatoes in Indonesia had increased since 2014 to 2016 to 2,503 kg / cap / year. However, in 2017 it decreased to 2,220 kg / cap / year and increased again in 2018 to 2,282 kg / cap / year (Data and System Center Agricultural Information, 2018). Along with the increase in the consumption of potatoes, the production of potatoes must be balanced to be able to meet this consumption need.

**Table 1. Harvested Area, Production, and Productivity of Potato Farms in the National Level, East Java Province, and Magetan Regency in 2018**

Information	Harvested Area (ha)	Production (tons)	Productivity (ton / ha)
Indonesia	68,683	1,284,763	18.70
East Java Province	13,390	312,967	23.37
Magetan Regency	342	4,970	14.53

Sources: (Central Bureau of Statistics, 2019a, 2019b, 2019c)

The average potato production in Indonesia in 2018 was 1,284,763 tons and East Java was the province with the highest potato production compared to the other provinces, which was 312,967 tons. Potato production in Magetan Regency in 2018 was 4,970 tons and was in seventh position after other regencies / cities in East Java Province. There are only two districts in Magetan Regency that produce potatoes, one of which is Plaosan District with a total production in 2018 of 4,640 tons with a harvest area of 320 ha (BPS, 2019a, 2019b, 2019c). Plaosan District is located at an altitude of 500 meters up to 1,280 meters above sea level and Setiadi (2009) explains that potato is suitable to be planted in the highlands or mountainous area with an altitude between 500-3000 meters above sea level. It makes Plaosan District suitable for planting potatoes.

Farmers in Plaosan district cultivate granola and atlantic varieties of potatoes. The granola variety has an oval shape with yellow skin color and has a low dry matter. It is more suitable for consumption as vegetable. Atlantic has a white colored flesh with scaly clean skin and relatively round shape. High starch content makes it suitable for industrial processed foods such as chips (Juiwati et al., 2018; Webb et al., 1978; Wibowo et al., 2018). Granola potato farmers independently use their

capital to run potato farming, while Atlantic potato farmers form partnership with Indofood, Ltd. and obtain capital assistance in the form of seeds, and are bound by contracts. The difference between the two varieties can be seen from the selling price. Based on the data from potato traders in Plaosan district, selling prices from farmers for granola variety potatoes ranged from Rp 6,000 / kg to Rp 8,500 / kg, while atlantic varieties of potatoes amounted to Rp 6,970 / kg. The different varieties of potatoes planted allow for differences in yields, costs for using production inputs, income, and profits received by farmers.

Rahman's research (2018) on the comparison of income and profit of Granola and Cipanas potato farming in Kayu Aro District, Kerinci showed the differences between the two. The average income of Granola potato farmers was IDR 47,582,407.41 / Ha / MT, higher than Cipanas variety of potato farmers, which was IDR 8,301,239.67 / Ha / MT, while the average profit obtained by potato farmers in the granola variety was IDR 42,718,814.81 / Ha / MT and cipanas variety was IDR 5,057,190.08 / Ha / MT. The results of statistical tests showed that there were significant differences in income and profits of the two varieties and showed that the farming of granola variety is more profitable.

Juiwati et al. (2018) in her research also showed that the cultivation of Granola potato in Sempol District was more profitable than the Atlantic variety. The results showed a difference in production costs, amounting to IDR 22,500,079 for granola varieties and IDR 22,146,941 for Atlantic varieties. Statistical test results on the profit variable showed a difference. The Granola variety profits were amounting to IDR 37,027,999/ha compared to Atlantic variety which were amounting to IDR 15,700,553. Research by Nuraeni et al. (2018) showed that there is a difference in income between superjhon and granola potato farming at a 95% confidence level. The results of her study showed the difference between the incomes of the two farms amounted to IDR 16,960,111 and higher income of the granola potato variety farming.

Based on this description, it is necessary to conduct a study entitled "Comparative Analysis of Granola and Atlantic Potato Farming in Magetan Regency" which aimed (1) to analyze the magnitude of costs, receipts of productivity, income, profits, efficiency, and profitability of granola and atlantic varieties of potato farming; (2) comparing the differences in productivity, income, profits, efficiency, and profitability of the granola and atlantic variety of potato farming in Plaosan District, Magetan Regency.

## **RESEARCH METHODS**

This research used analytical descriptive method and survey method. Descriptive analytical method is a systematic method to provide answers to a problem by collecting data, then processed and concluded. Survey method is a method of data collection by interview technique based on a list of questions or questionnaires given to the respondent farmers. The location of the study was determined purposively in two villages in Plaosan district, Magetan Regency, namely Buluharjo Village and Dadi Village with the consideration that both villages attempted two potato varieties with quite high production compared to other villages. This study used 100 samples consisting of 50 samples of granola potato farmers and 50 samples of Atlantic potato farmers. Table 2 presents data on the number of

populations and samples of granola and atlantic varieties of potato farmers in Plaosan District, Magetan Regency.

**Table 2. Number of Populations and Samples of Potato Farmers of Granola and Atlantic Varieties in the Plaosan District, Magetan Regency**

Potato Varieties	Village Samples	Farmer Population (people)	Sample Farmers (people)
Granola	Dadi	20	15
	Buluharjo	45	35
	Total	65	50
Atlantic	Dadi	65	37
	Buluharjo	23	13
	Total	83	50

Source: Village Data Collection, 2019

Samples taken were smallholders and the determination of the number of samples in each village proportionally. Sampling method used was the simple random sampling method. The data used were quantitative data in the form of the calculation and measurement of granola and atlantic varieties of potato farming. Primary data sources were obtained from direct interviews with respondent farmers. While secondary data sources were obtained from government agencies or related institutions, namely the Central Statistics Agency, the Department of Agriculture and Food Crops in Magetan Regency as well as from other relevant agencies in this study. Data collection was done by observation, interviews, and documentation.

Data analysis methods were used to answer the objectives of the study. Cost analysis used an explicit cost and implicit cost approach (Hoetoro, 2018). Productivity as a result of the ratio between total production and area of arable land was expressed in kg / ha (Mubyarto, 1989). Revenue is the product of production multiplied by the selling price and expressed in units of Rp / ha / MT (Soekartawi, 2016). Revenue was calculated by looking at the difference between revenue and total explicit costs, while the profit was calculated based on the difference between revenue and total costs (explicit or implicit) and expressed in units of Rp / ha / MT (Purwaningsih, 2017). Efficiency was calculated using the R / C ratio (revenue cost ratio) with the criteria: if the R / C ratio  $\geq 1$  then farming is said to be feasible to be cultivated and if the R / C ratio  $< 1$  then farming is said to be unfit for business (Soekartawi, 2016). Profitability could be determined by comparing the profits with the total costs incurred and multiplied by 100%, with the criteria if the result  $> 0$  is favorable, = 0 BEP, and  $< 0$  is unprofitable or loses (Prawirokusumo, 1990).

The difference between productivity, income, profit, efficiency, and profitability of potato farming of granola and atlantic varieties was known by the comparative test using Z distribution statistical test. Hypothesis testing of two mean averages with Z distribution is performed on large samples ( $n > 30$ ) (Hasan, 2012). The testing procedure is as follows:

a. Determine the formulation of the hypothesis to be tested, namely:

$H_0$ :  $X_1 = X_2$ , meaning that there is no difference in productivity, income, profit, efficiency, and profitability between the granola and atlantic varieties

$H_1$ :  $X_1 \neq X_2$ , meaning that there are differences in productivity, income, profits, efficiency, and profitability between the granola and atlantic varieties

- b. Determining the value of  $\alpha$  and the value of the Z table ( $Z_{\alpha}$ ), the assessment was done at 95% confidence level ( $\alpha$  0.05), and then determine the value of  $Z_{\alpha}$  or  $Z_{\alpha/2}$  of the table.
- c. Calculate the calculated Z value using the following formulation.  
 Explanations:
  - $X_1$  = Average productivity/income/ profit/ efficiency/ profitability of the granola potato farming
  - $X_2$  = Average productivity/ income/ profit/ efficiency/ profitability of the Atlantic potato farming
  - $S_1$  = Variants of productivity/ income/ profit/ efficiency/ profitability in the granola potato variety farming
  - $S_2$  = Variants of productivity/ income/ profit/ efficiency/ profitability in atlantic varieties of potato farming
  - $n_1$  = Number of sample farmers producing granola potato varieties
  - $n_2$  = Number of sample farmers producing atlantic potato varieties
- d. Make conclusions from the test results by looking at the  $Z_{\text{calculated}}$  value and  $Z_{\text{table}}$ .

## RESULT AND DISCUSSION

### Potato Farming Performance

Potato farmers in Plaosan district planted potatoes in the third or dry season (July - October), usually after the rice planting period. Farmers who choose to plant granola varieties are experienced in planting them, and never discouraged even though the selling price adjusts to market conditions. Farmers assume that the quality of the granola variety is superior and more resistant to disease than Atlantic variety. This is evidenced by the lack of granola potato plants in the study site affected by *fusarium wilt* or better known by farmers as "munus" disease. Farmers who work on granola variety generally use their own capital and rarely lend to outsiders, such as banks, cooperatives or others. Granola potato farmers buy seeds from the Banjarnegara, Batu, Bandung, Sarangan, or markets in the Plaosan area.

The new potato variety, Atlantic, attracted the attention of farmers with the capital assistance in the form of seeds from PT Indofood. Payment of seed cost is done after harvest expected in late cutting the harvest without the imposition of lending rates. That is one of the reasons why farmers choose Atlantic varieties, besides that the selling price is certain and steady. Farmers who grow Atlantic varieties of potatoes form a partnership with Indofood Ltd. and farmers were informed the price of seeds and selling prices of their harvests at the beginning of the collaboration. Similar to the atlantic variety, potato farmers in Sempol district studied by Juiwati et al. (2018) will give special treatment to potato seeds by splitting the seedlings according to their shoots.

The granola potato market segmentation was a market around the research area and the majority of farmers sold to middlemen for practical reasons. Farmers would sell to middlemen who buy their crops regularly. While the Atlantic potato market segmentation is Indofood Ltd. Due to the contract and harvest would be fully sold to Indofood Ltd. Another reason why farmers grow granola variety is that the proceeds from sales can be directly received on the day of harvest or the day after. Unlike the Atlantic varieties, farmers only receive results from sales approximately one month after the harvest is done.

Generally, the cultivation process of Granola and Atlantic varieties is relatively the same and the majority of farmers do not carry out their own nurseries. First is processing the land using a tractor, then the ground is leveled and made ridges with a width of 70-80 cm, height of 30-40 cm, and length adjusting the size of the fields. The process of planting is done by inserting potato seeds into the soil at a depth of 3-5 cm and a spacing of 20-25 cm. Farmers do the weaning twice with the aim of loosening the soil so that the water and nutrients will be easily absorbed by the root system. The first weaning is at 20-25 HST and the second weaning is at 35-40 HST. Farmers fertilize twice, namely basic fertilizers and supplementary fertilizers which are carried out simultaneously with the first weaning. On the other hand, the farmers in Kayu Aro district, Kerinci Regency, fertilize their potato planting four times or every 20 days (Rahman, 2018).

One of the plant cares which are carried out by farmers is pest and disease control by using pesticides. Generally, the pests that attack the plants are soil caterpillars, aphids, and leaf-cutting pests, and the disease is *fusarium* wilt. The irrigation process is carried out by farmers using the *leb* system on paddy fields and sprinklers on the farming land. In contrast to farmers in Garut Regency who do the process of replanting on dead potato plants (Maulia, 2012), farmers in Magetan Regency do not carry out the same process because the growth of new potatoes will be hampered. Some farmers do a marker installation on potato planting. Potato plants are ready to be harvested at the age above 90 days or adjusted to the plant endurance.

### Potato Farming Costs

Cost incurred by farmers for the process of potato farming is called Farming Cost. It is calculated using an explicit and implicit cost approach. Explicit costs are costs that are actually incurred by farmers and implicit costs are costs that are not really incurred or costs that are sacrificed (*opportunity cost*). Table 3 provides information on the explicit and implicit average costs of granola and atlantic varieties potato farming.

**Table 3 . Average Explicit and Implicit Cost of Granola and Atlantic Varieties Potato Farming in Plaosan District, Magetan Regency, Planting Period July-October 2019**

No	Usage Type	Granola Varieties		Atlantic Variety	
		IDR / ha	%	IDR / ha	%
1	Explicit Costs				
	a. Production Facilities				
	1) Seedlings	22,410,000	22.61	24,062,727	24.72
	2) Dolomite	68,000	0.07	14,545	0.01
	3) Fertilizer	9,950,900	10.04	8,793,455	9.03
	4) Pesticides	4,470,040	4.51	3,603,546	3.70
	5) ZPT	466,600	0.47	350,364	.36
	6) Adhesives	553,000	0.56	433,637	0.45
	7) Stakes/Markers	820,000	.83	1,031,818	1.06
	8) Wires	72,000	0.07	98,182	.10
	b. Outsourcing workers Fees	14,495,250	14.63	14,181,364	14.57
	c. Land tax	97,200	.10	95,698	.10

d.	Tractor Costs	3,050,000	3.08	2,709,091	2.78
e.	Foreign Capital Interest	0	0.00	0	0.00
f.	Transportation costs	0	0.00	560,000	0.58
	total	56,452,990	56.96	55,934,427	57.47
2	Implicit Costs				
a.	Workers fee	29,541,750	29.81	28,303,545	29.08
b.	Depreciation	570,633	0.58	662,667	0.68
c.	Land rental	9,720,000	9.81	9,569,782	9.92
d.	Own Capital Interest	2,817,790	2.84	2,842,093	2.92
	total	42,650,173	43.04	41,388,087	42.53
	Total cost	99,103,163	100.00	97332,514	100.00

Source: Processed from primary data (2019)

Table 3 shows that the total cost of producing granola variety is greater than atlantic variety. The biggest expense of the two farming is the cost of labors. The largest labor force is used at harvest time which is carried out cooperatively and has become a community tradition commonly known as "sambatan", so that labor costs are not actually incurred by farmers because they help voluntarily. The use of outsourcing labors depend on the area of farming, income of farmers, and the number of workers in the family. The more extensive the farm, the greater the farmer's income, the greater the farmer's ability to pay for outsourcing labors, but the greater number of workers in the family will minimize the use of them. (Suratiah, 2006).

The types of fertilizers used are SP36, Phonska, Animal waste, Organic, ZA, KCl, and NPK. The use of pesticides on the farm is relatively the same, but the selection of the brand is different for each farmers. The amount of land tax and land rent costs depends on the condition of the land. The calculation of the cost of capital interest is based on the interest rate of BRI bank, which is 15% per year. Foreign capital interest is calculated from borrowing interest and self-interest is calculated from the operational capital issued by farmers. Expenditures for higher production costs should be minimized by farmers, because the income and profits received will be affected. The less costs incurred, the bigger income and profits received (Mawardati, 2013) .

### Potato Farm Production and Productivity

Production is the result or output of farming which is influenced by the factors of production used (input). Productivity is a combination of the concept of the value of efficiency of farming with land area capacity used in the production process. Table 4 shows the average production and productivity of granola and atlantic varieties of potato farming in Plaosan District, Magetan Regency.

**Table 4 . Average Production and Productivity of Granola and Atlantic Varieties in the District of Plaosan District, Magetan Regency, Month Period July to October 2019**

No	Description	Granola Varieties	Atlantic Variety
1	Production (kg)	2,259.00	2,059.00
2	Land Area (ha)	.10	.11
3	Productivity (kg / ha)	22,590.00	18,718.18

Source: Processed from primary data (2019)

The average area of the atlantic potato farmers was 0.11 ha compared to 0.10 ha of granola potato farmers' area. The average production of potato farming for granola varieties was 2,259 kg and for Atlantic varieties was 2,059 kg. The productivity value of granola variety was higher at 22,590.00 kg / ha compared to atlantic variety at 18,718.18 kg / ha. Potential production of granola variety could reach 30-35 tons / ha, while Atlantic variety had the potential to reach 20 tons / ha (Setiadi, 2009). This shows that the production of potatoes in the Plaosan District, Magetan Regency needs to be increased to reach the potential production of the potato crops.

The difference in productivity values was due to the higher average yield of granola variety and higher disease resistance compared to other varieties (Wibowo et al., 2018). The length of time a farmer planted a variety of granola was also one of the factors that influence the value of higher productivity. However, the productivity value of Atlantic variety in Plaosan District was closer to the production potential compared to granola variety. The ability to produce 60 gram-sized tubers as *grade A* and the tuber yields that are almost uniform in size compared to other varieties are the advantages of atlantic variety (Setiadi, 2009).

### **Income, Revenue, Profit, Efficiency, and Profitability of Potato Farms**

Incomes are the result of multiplication between total production and the prevailing selling price. Revenue is the result of the difference between incomes and the costs that actually incurred by farmers (explicit costs) during one growing season. Resources owned by farmers have a contribution that they will receive as much as implicit costs or costs sacrificed by farmers (opportunity cost). Profit calculation by considering the opportunity cost will be obtained how much real profit will be received by farmers. Calculation of efficiency is used to determine whether or not a potato farm is feasible to run, and profitability to determine whether or not the farm is profitable. Table 5 provides information on the average revenue, income, profits, efficiency, and profitability of potato farms of granola and atlantic varieties.

**Table 5 . Average Income, Revenue, Profit, Efficiency, and Profitability of Granola and Atlantic Potato Farming in Plaosan District, Magetan Regency, Planting Period July - October 2019 (per ha)**

No	Description	Granola Variety	Atlantic Variety
1	Production (kg)	22,590	18,718
2	Price (Rp / kg)	07008	6,970
3	Income (Rp) (1x2)	158,310,720	130,464,460
4	Explicit Cost (Rp)	56,452,990	55,934,427
5	Implicit Costs (Rp)	42,650,173	41,388,087
6	Revenue (Rp) (3-4 )	101,857,730	74,530,033
7	Profit (Rp) (3-4-5 )	59,207,557	33,141.94 6
8	Efficiency [3 / (4 + 5 )]	1.60	1.34
9	Profitability [7 / (4 + 5 )]	0.60	.34

Source: Processed from primary data (2019)

Based on table 5 it is known that the average revenue and profitability of potato farming in the granola variety was higher than the Atlantic variety (Juiwati et al., 2018). Maulia (2012) showed that the revenue and profits of the Atlantic potato farming in Garut were higher than the granola variety. This difference occurred because the average production and selling price of granola variety was higher so



that the income and profits received by farmers of granola potatoes were higher than Atlantic variety.

The efficiency value of potato farming for granola variety was 1.60 and for Atlantic variety was 1.34, meaning that each farmer's expenditure of IDR 1.00 would provide revenue of IDR 1.60 for granola variety potatoes and IDR 1.34 for Atlantic variety potatoes. This shows that the potato farming of granola and atlantic varieties is feasible to be cultivated. The profitability value of potato farming in the granola variety is greater at 0.60 compared to atlantic variety at 0.34. Granola potato farming has more advantages than atlantic potato farming (Juiwati et al., 2018).

Comparative analysis was performed to answer the hypotheses of this study. The aim of this analysis was to compare the variables tested between the potato farming of granola and atlantic varieties whether there are any differences or not. The test was carried out using a statistical test of Z distribution (*z test*) at a 95% confidence level ( $\alpha$  0.05). Table 6 shows the results of a comparative analysis between potato farming of granola and atlantic varieties.

**Table 6. Comparative Analysis of Productivity, Income, Profit, Efficiency, and Profitability in Granola and Atlantic Potato Farming in Plaosan District, Magetan Regency, Planting Period July - October 2019**

No	Description	Granola Variety	Atlantic Variety	Variant		Z count	Z table ( $Z_{\alpha/2}$ = 0.025)	Conclusion
				Granola	Atlantic			
1	Productivity (kg / ha)	22,590	18,718	2.7E + 07	1,3E + 07	4.24	1.96	Different
2	Income (Rp / ha / MT)	101,857,730	74,530,033	1,3E + 15	4,6E + 14	4.51	1.96	Different
3	Benefits (Rp / ha / MT)	59,207,557	33. 141.94 6	1,3E + 15	4,3E + 14	8.77	1.96	Different
4	Efficiency	1.60	1.34	.11	0.04	4.72	1.96	Different
5	Profitability	0.60	.34	.11	0.04	4.72	1.96	Different

Source: Processed from primary data (2019)

Based on the results of the Z distribution statistical tests show that the  $Z_{\text{calculated}}$  value of each variable tested is greater than the Z value of the  $Z_{\text{table}}$ . This means that the hypothesis is accepted, meaning that there are differences between the potato farming of granola and atlantic varieties. The results show that granola potato farmers received higher incomes and profits compared to atlantic potato farmers. This is in line with the research of Juiwati et al. (2018), Rahman (2018), and Nuraeni et al. (2018) which stated that potato farming of granola variety provides more advantages than the Atlantic, cipanas and superjhon varieties. Atlantic potato farmers who collaborate or form partnership with Indofood, Ltd. have the positive side of getting capital assistance in the form of seeds without applying loan interest. The negative sides of the collaboration are that farmers get relatively cheaper selling prices, harvest payment can be received by farmers approximately 30 days after harvest, and the value of productivity is lower with a larger harvested area compared to granola variety.

## CONCLUSION

Based on the formulation of the problem, research objectives, and research results it can be concluded that there are differences between the two potato farms and the results indicate that the productivity, income, benefit, efficiency, and

profitability of potato farming of granola variety are higher than Atlantic variety. Theoretical implications show that land area and crop yields affect farming productivity, and costs and revenues have influence the income and profits. Practical implications are used as input for farmers on the selection of potato varieties to be planted and efforts to maximize farm care to further improve farm productivity, income, and profits that will be received.

## RECOMMENDATION

Based on the results of research that shows that the productivity of potato farming for granola and atlantic varieties is still far from production potential, the suggestion that can be given is that farmers should maximize their potato farming care to increase productivity, income and profits. The government should increase the role of agricultural extension workers in the delivery of information on how to cultivate potatoes more precisely and efficiently with the aim of increasing the productivity of the cultivated potato plants so that they can reach the potential of potato production.

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