



Perception and Behavior Pest and Disease Control of Granola Potato in Paguyangan Sub-district, Brebes Regency, Central Java, Indonesia

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Abstract. Potato price tends to fluctuate, and the cost of production is quite high, causing the interest of farmers in growing potatoes to decline. Picture of the level of knowledge of farmers in the control of pests and diseases in potato crops, the perception of farmers in the control of potato pests and plant diseases, the potato attitude of farmers to control pests and diseases of potato crops, behavior of farmers in the control of pests and diseases in potato crops related to the concept of integrated pest management and still keep, preserve the environment. This study aimed to determine the implementation of pest and disease control. The number of respondents and 100 samples selected by purposive sampling to represent the overall consideration of potato farmers who are members of farmer groups in the village of Paguyangan sub district. Retrieval of data using questionnaires and interviews. Data were analyzed with nonparametric statistical using Spearman correlation. The results showed that The results showed that 80% of respondents had a high level of knowledge of the category, 15% of respondents had a neutral of knowledge and 5% of respondents had low and have a positive correlation on the behavior of farmers in the control of potato pests and plant diseases; perception of 67% of respondents had a neutral perception, 30% of respondents had a good of have perception, 3% of respondents had a bad of have perception of positive and negative correlation on the behavior of potato pest control; attitude 15% of respondents had a neutral stance, 85% of respondents had a good stance and 0% of respondents had a bad stance were positively correlated (0.485) to control the behavior of pests and diseases of potato.

Keywords: Potato · Behavior · Farmers · Perception · Granola

1 Introduction

Efforts to realize national food security are a national agenda that involves various stakeholders, and is very complex by covering various aspects of the nation, and is a priority for the Indonesian nation [1] Horticultural commodities such as potatoes are strategic commodities, and consumption is quite high reaching 2,282 kg/capita and

Brebes Regency ranks third in producing potato commodities produced from 2 sub-districts, namely Paguyangan and Sirampog [2]. Agroecologically, Pandansari Regency has areas that can be developed for potato cultivation, such as the Paguyangan sub-district [3]. Paguyangan District is a potato-producing center in Brebes Regency. Paguyangan District has the potential for potato development which is supported by the Kaligua tourist attraction area. The area that has the right topography for planting potatoes in Paguyangan District is Pandansari Village.

Pandansari Village has suitable agroecology for potato cultivation. Farmers cultivate potatoes using granola varieties with the advantages of being resistant to plant pest organisms (OPT), shorter planting age, use of seeds from previous plantings, and having a fairly high price in the market [4]. Pandansari Village, Paguyangan District, Brebes Regency is one area that has great potential in terms of potato production. The suitability of the natural conditions in the village with the conditions for growing potato plants and the high economic value of potatoes are the main reasons most farmers in the area choose potatoes as their main agricultural commodity. Potato productivity in Pandansari Village, Paguyangan District reached 20 tons/hectare. Total potato production in Pandansari Village, Paguyangan District reached 320 tons with a harvested area of 16 hectares in 2019. Potato production in Pandansari Village reached 147,960 kw with a harvested area of around 822 ha in 2019, but the number decreased in 2020 to 131,436 kw with a harvested area of 730 ha [2]. Potato (*Solanum tuberosum* L) is an agricultural commodity that deserves to be prioritized because it has an important meaning in the realization of food security. Besides having a high economic value, potatoes can also be used as an alternative food ingredient and as a raw material for the food industry [5]. In 2015 potato consumption was 2,284 kg/capita/year, increased in 2016 by 2,503 kg/capita/year, in 2017 it decreased by 2,220 kg/capita/year, while in 2018 it again increased by 2,282 kg/capita/year. This increase in potato consumption indicates that potato production needs to be increased both in quality and quantity so that availability is maintained [6].

The magnitude of the potential for potato plantations in Pandansari Village, Paguyangan District, Brebes Regency, needs to be considered in the right way to control pests and diseases, because the behavior and perceptions of these farmers will affect the success of pest and disease control, especially in potato plants. The large potential of potato plantations in Pandansari Village needs to be considered as well as pest and disease control. Potato plants are plants that have the most pests and diseases, consisting of 266 pests and diseases consisting of 23 viruses, 38 fungi, 6 bacteria, 2 microplasma, 1 viroid, 68 nematodes and 128 insects [7]. Control measures are taken because pests and diseases are one of the biological limiting factors and threats that cause low production achieved by farmers, therefore it is necessary to research on the perception and behavior of farmers in controlling, in order to formulate a program in Pandansari Village, Paguyangan District, Brebes Regency so that control can be carried out appropriately. Another obstacle is the occurrence of climate anomalies so that pests and diseases are difficult to control by farmers [8]. Based on the survey results, the presence of pests and diseases also influenced the decline in farmers' interest in planting potatoes, and switching to cultivating other agricultural commodities. This decrease in interest can lead to a decrease in potato production the high demand for potatoes is not matched by high productivity, which is

an obstacle in potato cultivation [9]. Furthermore, Based on the results of a qualitative survey in the field, each period of potato planting, farmers in controlling pests and diseases of potato plants generally use synthetic pesticides. The continuous use of synthetic pesticides in pest and disease control, if not done wisely, will have an impact on human health and the surrounding environment. The use of synthetic pesticides that are continuously carried out by farmers in controlling pests and diseases on potato plants and the large potential of potato plantations in Pandansari Village, Paguyangan District, Brebes Regency, encourages them to conduct research with the title: perceptions and behavior of farmers in controlling pests and diseases of Potato plants (*Solanum tuberosum* L.) In Pandansari Village, Paguyangan District, Brebes Regency, this study was to determine the knowledge, perceptions, attitudes and behavior of farmers in controlling pests and diseases of potato plants.

This research can be useful to increase the interest of farmers to continue developing potato cultivation and as information in environmental management efforts and control of potato plant pests and diseases. This study aims to determine the level of knowledge of farmers in controlling pests and diseases in potato plants, to determine farmers' perceptions in controlling pests and diseases of potato plants, to determine the attitudes of farmers in controlling pests and diseases of potato plants, to determine the behavior of farmers in controlling pests and diseases. Disease in potato plants in Pandansari, Paguyangan District, Brebes Regency, It is hoped that potato production can continue to increase and the income obtained by farmers can be more optimal. The problems studied in this study were to determine the level of knowledge of farmers, farmer perceptions, farmer attitudes, farmer behavior in controlling pests and diseases of potato plants, especially granola. The data were analyzed statistically using Spearman correlation.

2 Materials and Methods

This research was conducted in June–November 2021. Respondents were potato farmers who were members of a farmer group in Pandansari Village, Paguyangan District, Brebes Regency. The farmer sampling technique was obtained by using probability sampling technique using the simple random sampling method. In accordance with the existing population, the determination of the number of samples using the Slovin formula [10] (Sujarweni & Endrayanto, 2012) is as follows:

$$n = \frac{N}{1 + N(e^2)}. \quad (1)$$

where: n: number of sample, N: number of population, and e: error tolerance

Based on the calculation, the number of farmer respondents was 99.42 rounded up to 100 respondents. Furthermore, after collecting research data, data analysis was carried out. The purpose of data analysis is to compile and interpret the data that has been obtained. This study uses nonparametric statistical analysis. This analysis was conducted to see the relationship of the two variables. The two variables are the main variables, namely the influence variable (independent) and the uninfluenced variable (independent). In this study, the bivariate statistical test used the Spearman correlation analysis method. Spearman coefficient test is used to see the strength of the relationship

Table 1. Determination of the categories of farmer knowledge in controlling pests and diseases on potato plants

Score number scale	Score after converted (%)	Category
0–8.3	0–33	Poor
8.4–16.7	34–67	Fair
16.8–25.0	68–100	Good

between two variables that have an ordinal measurement scale, namely to see the strength of the relationship between the independent variable (knowledge, perception, attitude in controlling potato plant diseases) and the dependent variable (behavior of farmers in controlling potato pests and diseases). To find out the correlation, the researcher uses the correlation formula proposed by Rank Spearman which is known as the Spearman correlation formula (Rho) [11].

$$\rho_{xy} = 1 - \frac{6\sum D^2}{N(N^2 - 1)} \quad (2)$$

where: D: Differences. Often used also B stands for Beda. D is the difference between the level of each subject (X and Y for each subject), N: number of sample 1, and 6 is constant number

Types of data collected include primary and secondary data. Primary data was collected through tests. Tests were conducted to determine the level of knowledge of farmers in controlling pests and diseases, through questionnaires, direct interviews. Secondary data were collected from various agencies/institutions related to the research, such as the Central Bureau of Statistics of Brebes Regency, the Agricultural Extension Center of Paguyangan District, and the Pandansari Village Office. The analytical methods used are as follows:

2.1 Knowledge Level Instrument in Pest and Disease Control

The instrument to measure the level of knowledge of farmers in controlling pests and diseases of potato plants is arranged in the form of a knowledge test, which is guided by the measurement of the Guttman Scale type, namely the form of questions with two alternative choices, true and false. The correct answer choice is given a weight of 1, and the wrong answer choice is given a weight of 0 (true = 1, and wrong = 0) [12].

The indicators of this instrument include problems of Pests, diseases, pest and disease control, the use of synthetic and vegetable pesticides in pest and disease control, the impact of synthetic pesticides on human health and the environment, pest and disease control with the principles of Integrated Pest Management (IPM) (Table 1).

2.2 Perception Instruments

Farmer's perception instrument in controlling potato plant pests and diseases. The instrument used to measure farmers' perceptions in controlling pests and diseases of potato

Table 2. Determination of the categories of farmer's perceptions in controlling pests and diseases in potato plants

Score number scale	Score after converted (%)	Category
25–58.3	0–33	Poor
58.4–91.7	34–67	Fair
91.8–125	68–100	Good

Table 3. Determination of the categories of farmer's attitude in controlling pests and diseases in potato plants

Score number scale	Score after converted (%)	Category
25–58.3	0–33	Poor
58.4–91.7	34–67	Fair
91.8–125	68–100	Good

plants will be carried out using a Likert Scale regarding the opinion of farmers in controlling pests and diseases in potato plants which are stated with alternative responses, namely Strongly Agree (5); agree (4); indecisive (3); Disagree (2); and Strongly Disagree (1) for positive statements, while for negative statements Strongly Disagree (5); Disagree (4); Doubtful (3); Agree (2) and Strongly Agree (1) (Table 2).

2.3 Instruments of Farmers' Attitude in Controlling Pests and Disease on Potato Plants

The instrument used to measure the attitude of farmers in controlling pests and diseases of potato plants. This instrument is arranged in the form of a questionnaire that is guided by the measurement of the Likert Scale type, which uses five alternative answers: Strongly Agree (SS), Agree (S), Doubtful (RG), Disagree (TS) and Strongly Disagree (STS) for positive statements are given a score of SS = 5, S = 4, RG = 3, TS = 2 and STS = 1, and vice versa for negative statements are given a score of SS = 1, S = 2, R = 3, TS = 4 and STS = 5 [12].

The instruments at this point in the attitude of farmers in controlling pests and diseases on vegetable crops include the use of synthetic pesticides, the use of vegetable pesticides, the return of crop residues and environmental sanitation, the impact of the use of synthetic pesticides on human health and the environment, pest and disease control with an Integrated Pest Management system (IPM), seed selection and crop rotation (Table 3).

Table 4. Determination of the categories of farmer's behavior in controlling pests and diseases in potato plants

Score number scale	Score after converted (%)	Category
25–58.3	0–33	Poor
58.4–91.7	34–67	Fair
91.8–125	68–100	Good

2.4 Farmer Behavior Instruments in Controlling Pests and Diseases on Potato Plants

This instrument is used to measure the behavior of farmers in controlling pests and diseases of potato plants. This instrument is structured in the form of a questionnaire based on the Likert Scale, which proposes a statement form with five alternative choices, namely; never (TP), rarely (J), Sometimes (KK), often (SR) and always (SL). For statements that are positive are given a score: SL = 5, SR = 4, KK = 3, J = 2, and TP = 1, and vice versa for statements that are negative are given a score of SL = 1, SR = 2, KK = 3, J = 4, and TP = 5, the criteria as stated by Sugiyono (2005) as always (SL), often (SR), sometimes (K), never (P), and never (TP).

The behavioral instruments of farmers in controlling pests and diseases of vegetable crops include the use of synthetic pesticides, the use of vegetable pesticides, the return of crop residues and environmental sanitation, the impact of the use of synthetic pesticides on human health and the environment, pest and disease control with the Integrated Pest Management (IPM) system, seed selection and crop rotation (Table 4).

3 Results and Discussion

3.1 The Results of the Value of Farmer Knowledge in Controlling Potato Pests and Diseases in Pandansari Village, Paguyangan District, Brebes Regency Before and After Conversion

Based on Table 5 shows that all respondents have knowledge with a high category in controlling potato pests and diseases, this is presumably because farmers in Pandansari Village, Paguyangan District, Brebes Regency, have an average age of 33–35 years. Facilitate the transfer of information and capture knowledge more quickly, respondents are also active in farmer groups, this makes it easier for agricultural extension workers to facilitate coordination and sharing, especially in controlling pests and diseases in potato plants, with good farmer insight it will encourage attitudes that will encourage the occurrence of changes in behavior. This agrees with [13] that what is meant by what is known about an object is something including the physical environment such as soil, air, water, smells, rocks and others, then the biological environment such as plants, animals, algae, fungi or others. Even bacteria, the social environment is the interaction between humans and the environment so that someone who has extensive

Table 5. Knowledge value of respondents

No	Description	Farmer perception value	
		Before conversion	After conversion
1	Average	24.80	93.15
2	Maximum	23	96
3	Minimum	22	88
4	Modus	24	90
5	Standard Deviation	1.45	5.49

knowledge, especially environmental knowledge, will be able to solve and find solutions to problems. Then further research from [14] that basically knowledge comes from 3 kinds, namely knowledge that is directly obtained, results from conclusions and is obtained from testimony and authority.

Based on the theory of knowledge, it can be said that what is meant by knowledge of potato plant pest and disease control is what has been understood, known by farmers both through formal and non-formal education. This can be seen in the farmers in Pandansari village who received both the information conveyed by the extension workers, then practiced such as how to multiply biological agents, manufacture of botanical pesticides, when is the effective time for spraying, eradication, crop rotation good and right.

According to the level of knowledge in Table 6, it shows that as many as 100 respondents (100%) have a high category of 80%, a medium category of 15% and 5% of a knowledge category with a low category. The behavior of farmers, the higher the knowledge, the higher the behavior in controlling pests and diseases on potato plants. This agrees with what was stated by [15] that environmental knowledge has a positive effect on community behavior in environmental sanitation, this is shown by farmers in Pandansari Village, Subdistrict Paguyangan Brebes, farmers carry out eradication of weeds that can be alternative hosts for both vector and pest pests, farmers routinely carry out eradication and environmental sanitation at least 2 times a week, potato cultivation areas are endeavored to prevent transmission of both diseases, kits or pests, besides that, farmers are also very careful about the use of synthetic pesticides and pay attention to the dosage in use, because farmers understand that using unlimited doses of synthetic pesticides will damage the environment and cause resistance to pests or diseases.

3.2 The Results of Farmers' Perception Values in Controlling Potato Pests and Diseases in Pandansari Village, Paguyangan District, Brebes Regency Before and After Conversion

Based on Table 7. The analysis shows that all respondents have a perception with a high category. This shows that farmers in pandansari village understand the importance of how to use synthetic pesticides so as to produce potatoes that are safe for consumption

Table 6. Distribution of respondents by level of knowledge

Score scale	Number of farmers	Percentage (%)	Category
0–33	5	5	Poor
34–67	15	15	Fair
68–100	80	80	High

Table 7. Respondents' perception value

No	Description	Farmer perception value	
		Before conversion	After conversion
1	Average	89.99	72.81
2	Maximum	92	74
3	Minimum	82	79.40
4	Modus	89	88
5	Standard Deviation	1.93	0.74

and do not leave residues that will harm human health. The information conveyed by the extension agents affects the perception of farmers on how to control pests and diseases in potato plants. This is supported by the statement of [16] that perception is the process of giving meaning to the environment by an individual, because each person gives meaning to the stimulus, the organization of the stimulus and the interpretation of the stimulus that has been organized in a way that can affect behavior and behavior shape attitudes. Thus it can be said that perception includes what is seen, thought and felt by a person on the stimulus he receives from the environment.

According to the level of perception in Table 8, as many as 100 respondents (100%) of 67% in the medium category, 30% in the good category and 3% in the perception category with the Bad category. People's perceptions differ from each other in the same situation because of cognitive differences, this is in accordance with [17] statement that each individual's mental processes work in their own way depending on personality factors such as tolerance for ambiguity, level of openness or closedness of mind, attitude authoritarian. Most of the farmers in Paguyangan village, on average, 67% with high school education are able to accept the process of receiving information that is in the farmers and then turn it into psychological awareness, relative, selective, organized and directed in carrying out environmentally friendly pest and disease control of potato plants (Table 8).

Table 8. Distribution of respondents by level of perception

Score scale	Number of farmers	Percentage (%)	Category
0–33	3	3	Poor
34–67	67	67	Fair
68–100	30	30	High

Table 9. Farmer's attitude value

No	Description	Farmer perception value	
		Before conversion	After conversion
1	Average	85.18	74.20
2	Maximum	88	76.30
3	Minimum	79	76.39
4	Modus	85	74.25
5	Standard Deviation	1.20	0.93

3.3 The Results of the Attitude Value of Farmers in Controlling Potato Pests and Diseases in Pandansari Village, Paguyangan District, Brebes Regency Before and After Conversion

Based on Table 9, the analysis shows that all respondents have attitudes in the high category. The relation with attitude has to do with the learning process. The existence of an attitude will change because of the conditions and influences given, as a result of learning attitudes are not formed by themselves because the formation of attitudes will always take place in human interaction, this is related to encouraging action or not to control pests and diseases that are environmentally friendly, in relation to aspects of attitude. There are some farmers in pandansari village who already use botanical pesticides using natural ingredients, because there is an awareness that excessive use of synthetic pesticides will cause resistance to pests or leave residues on potatoes when consumed. Farmers in Pandansari villages have been able to behave positively, both in the form of real behavior, this is supported by the statement of [18] stating that attitude serves to arouse motives for behavior, both in the form of over-behavior and closed behavior (cover behavior) thus the attitude will affect two forms of a person's reaction in real or disguised forms. According to the level of attitude in Table 10, it shows that as many as 100 respondents (100%) amounted to 79% in the medium category, 20% in the good category and 1% in the knowledge category with the bad category.

Table 10. Distribution of respondents by level of attitude of farmers

Score scale	Number of farmers	Percentage (%)	Category
0–33	1	1	Poor
34–67	79	79	Fair
68–100	20	20	High

3.4 The Results of Farmer Behavior Values in Controlling Potato Pests and Diseases in Pandansari Village, Paguyangan District, Brebes Regency Before and After Conversion

Based on Table 11. The analysis shows that all respondents have a behavior with a high category. In each person will behave differently from one another and are influenced by their environment, human behavior is a function of individual interaction with their environment, in this case the farmers in Pandansari village in how to cultivate potatoes, choose varieties, control pests and diseases differently. With other areas. This is in accordance with the statement explained by [19] that environmental behavior is a function of the interaction between an individual and his environment, so that the activities that occur are mutually beneficial relationships in developing environmentally friendly behavior or improving environmental quality. Behavior that is environmentally friendly will cause the environment to remain sustainable, otherwise behavior that is not environmentally friendly will actually cause degradation. Human behavior in the social life of society is a function of the interaction between individuals and their environment. Everyone will behave differently from each other and is influenced by their environment. Human behavior is a function and interaction of the individual (person) with the environment. Human behavior between each other is not the same, because the behavior is determined by each different environment. The individual brings into the organizational order his abilities, personal beliefs, expectations, needs, and past experiences, these are all characteristics possessed by the individual, and these characteristics are brought by him when he enters a new environment.

According to the level of behavior in Table 12 shows that as many as 100 respondents (100%) of 15% were in the moderate category, 85% in the good category and 0% in the behavior category with the bad category. The perception of farmers in pandansari village is influenced by the personal knowledge and experience of each farmer, including in controlling pests or diseases in potatoes, especially in choosing pesticides, farmers prefer certain trademarks for reasons that are more effective.

3.5 The Influence of Knowledge Level, Perception and Attitude on Farmers' Behavior in Controlling Potato Pests and Diseases

Based on the results of the study that there are many factors that influence a person's behavior, among others, the level of knowledge, perceptions and attitudes. Spearman correlation results show that there is a significant effect between farmer knowledge, farmer

Table 11. Farmer's behavior values in controlling potato pests and diseases

No	Description	Farmer perception value	
		Before conversion	After conversion
1	Average	1.020	81.45
2	Maximum	112	86.78
3	Minimum	95	87
4	Modus	85	74.25
5	Standard Deviation	3.55	2.85

Table 12. Distribution of respondents by level of behavior

Score scale	Number of farmers	Percentage (%)	Category
0–33	0	0	Poor
34–67	15	15	Fair
68–100	85	85	High

perceptions and farmer attitudes together on farmer behavior in controlling pests and diseases of potato plants in Pandansari Village, Paguyangan District, Brebes Regency. 2), then H_0 is rejected, which means there is a significant relationship with a significance level of less than 0.01. From the variables that are thought to have an effect on farmer behavior and control of pests and diseases of potato plants, namely the knowledge factor (X1), perception (X2) and attitude (X3), the correlation can be seen. Based on Table 13, from the correlation output, it can be seen that there is a close relationship between all independent variables, namely the knowledge of farmers in controlling potato pests and diseases (X1), and farmers' attitudes in controlling potato pests and diseases (X3) have a positive correlation, parallel in the control of potato plant pests and diseases, while perceptions have a non-unidirectional parallel correlation. The significance value (sig.2 tailed) for all variables is below 0.05 (5%), this indicates that all independent variables (knowledge, perceptions and attitudes) which are included as predictors of the dependent variable (behavior) are significant. The independent variables are knowledge, perceptions and attitudes of farmers in controlling pests and diseases of potato plants (X1, and X3) which are included as predictors of behavior (Y), farmer behavior in controlling pests and diseases in potato plants has a positive correlation or parallel direction, while X2 has a non-unidirectional correlation. This shows that knowledge and attitudes have a positive effect showing parallel correlation with the behavior of farmers in controlling pests and diseases of potato plants in Pandansari Village, Paguyangan District, Brebes

Table 13. Correlation analysis among level of knowledge, perception and attitude of farmers

Variables	Coefficient correlation	Sig
Knowledge	0.592	0.000
Perception	-0.572	0.000
Attitude	0.485	0.000

Regency. Significance ($=0.000$) ($\alpha/2$), then H_0 is rejected, which means there is a significant relationship with a significance level of less than 0.01. Whether or not there is a correlation in the numbers on the index, however small the correlation index is if not 0.0000, it can be interpreted that between the two correlated variables, there is a correlation, the larger the number in the correlation index, the higher the correlation between the two correlated variables [11].

4 Conclusions

Based on the analysis, the results of the perception and behavior of farmers in controlling pests and diseases on potato in Pandansari Village, Paguyangan District, Brebes Regency were obtained in the high category of 80%, the medium category of 15% and 5% of the knowledge category with the low category. Respondents have a high level of knowledge and have a positive correlation (0.592) on the behavior of farmers in controlling pests and diseases of potato plants; perception of 67% in the medium category, 30% in the good category and 3% in the perception category with the bad category and negatively correlated (-0.572) to the behavior of controlling potato plant diseases by 15% in the medium category, 85% in the good category and 0% in the behavior category in the bad category has a positive correlation (0.485) on the behavior of controlling pests and diseases of potato plants.

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