The farmer's response to the improvement of cropping index through intercropping of maize – soybean and groundnut monoculture in Pemalang

E Nurwahyuni, F D Arianti and Y Hindarwati
Assessment Institute of Agricultural Technology – Central Java, Soekarno-Hatta
KM.26 No.10Bergas - Semarang, Central Java, Indonesia

Corresponding author: nurwahyuni.endah@gmail.com

Abstract. One of efforts to increase cropping index (CI), in rainfed lowland areas is by intercropping. In this system land can be planted with two or more types of plants at almost in same time, to improve farmer profit. Farmers' adoption of this technology varies and its response was influenced by the introduction process. This study aimed to determine the level of farmers response to corn-soybean intercropping technology and factors which affecting farmers response to the application of intercropping technology at Pemalang Central Java. This study using descriptive and quantitative data analysis from observation, interview and documentation. Thirty farmers as respondent were selected. In this study, analytical method was employed to determine the level of farmer response, meanwhile, regression analysis was used to determine the factors which influencing farmer response. The results showed that farmer response was high on land processing (69.57%), seed treatment (78.26%), spacing (95.65%), ease of planting corn (95.65%), ease of harvesting turiman-jale. (69.57%) and the ability to increase IP (65.22%). The variable of land area has significant effect to the response of turiman-jale technology and its increase linearly in farmer response for each addition of 0.88 hectares of land.

1. Introduction
The demand for food crops, both for consumption and industry, is increasing, while the raw area for agricultural land is decreasing. Climate as a supporting factor of the planting environment often changes. Earlier study DNPI [1] reporting the agricultural sector is experiencing direct disruption due to climate change. One of the best adaptation efforts to deal with impacts of climate change is to determine cropping patterns and planting calendars by considering climatic conditions [2]. Soybean is a commodity that is most sensitive to climate change because its production could be decrease 10.7% in El Nino conditions and by 11.4% in La Nina conditions [3]. Carolyn et al. [4] Climate change has resulted in improvement of rainfall volume in certain areas as well as drought in the other side. The most influential climate change is the reduced annual rainfall and the shifting of seasons which results in a lack of land capacity due to limited water, especially for rain-fed and dry land. Various efforts have been made so that food crop production continues to increase through the construction of water source units, planting drought-tolerant plants, applying cultivation technology with minimum irrigation to increasing the cropping index through intercropping. The intercropping system is an effort to increase land productivity with crop diversification, namely planting more than one type of plant on a plot of land simultaneously. This system is better known as multiple cropping or multiple cropping patterns [5]. The
multiple cropping patterns have advantages, i.e. that it can reduce the risk of crop failure, due to pest attacks or climatic disturbances in land use. According to earlier study Siti et al. [6], multiple cropping also has limitation, i.e. the existence of competition between plants, which has an impact on decreasing plant productivity.

Management of spacing and planting time is considered to be a factor that determines the success of intercropping [7]. In condition of too tight spaced will result in competition between plants for nutrients, sunlight and water so that it does not allow the plant to grow and develop maximally [8]. Through intercropping system, farmers can use the space for other crops. Furthermore, they can harvest more than one crop at the beginning of the rainy season until the end of the dry season. If the pattern occurs regularly, in one year farmers have about three to four months to increase the cropping index (IP). According to Tresliyana and Erythrina [9] and Haris et al. [10], the concept of IP enhancement is the optimization of space and time so it will be maximizing the cropping index, thus the production and farmer's income will increase. Increasing land productivity through this step considered as not only capable of addressing the increasing need for food but also improving the welfare of farmers.

Pemalang Regency is an area that has potential to be developed as center for secondary crops production. According to the listed data BPS 2017 [11], the total production of corn, soybeans and peanuts in Pemalang reached 58,397; 7,732 and 76 tons, respectively. Pemalang also has potential of rainfed land of rice fields (6,800 ha) and fields/drylands (1,013 ha), which on average can only be planted once a year, so that they have a rice-bero-bero or corn-bero-bero cropping pattern. The productivity of the land can be increased by cropping index enhancement. One of the recorded drylands is in the Ampelgading sub-district. The total area of this dry land is about 76 hectares, if the introduction of this technology is success, then its will impact to the large number of farmer.

The innovations in agriculture to improve the productivity is through the optimization of existing technology or to development the innovated one. At the level of innovation concept, the technology applied need to be wisely considered at the end user and the supporting factor of the implemented technology to be precise and quickly adopted. Previous facts show that the adoption of agricultural technology innovation at the farm level is still relatively low, therefore the achievement of agricultural productivity is not following the existing potential. This is due to the diverse of perceptions and responses of farmers to these technological innovations. The farmer's response is defined as a change in the attitude of the farmer due to stimuli from outside and from inside of the farmer. This study aims to obtain information on the response of farmers to the cropping index improvement through intercropping of corn/soybeans - peanuts in Pemalang Regency.

2. Methods
The study was performed in technology demonstration in Ampelgading sub-district, Pemalang Regency through intercropping of corn/soybeans (MT2) - peanuts (MT3), where the existing pattern is only planted at MT 1, the remainder is allowed to fallow. The response of farmers given by answering the form to the demonstration plot object of corn/soybean - peanut intercropping planted outside the season and farmers’ habits. The study was carried out on a five-hectare land from March to December 2019 in West Tegalsari Ds, Ampelgading District, Pemalang Regency involving 35 farmer, extension, Pests observers and related stakeholders. The assessment was carried out in several stages, i.e. at planting season (PS) 2, planting of soybeans in the second week of April, planting of corn in the first week of May, harvesting of soybeans and corn in July, for PS 3 of planting peanuts in the first week of August and peanut harvesting in the second week of October 2019.

The varieties of soybean and maize planted were Grobogan soybean and Bisi 18 maize varieties according to farmers’ interests and preferences. Before planting, seed treatment for soybean seeds was carried out. The soybeans were planted at a spacing of 20 × 10 cm, 2 seeds per hole, then covered with organic fertilizer. Corn was planted when the soybeans were two weeks old with a spacing of 75 cm × 40 cm. After the corn and soybeans were harvested, land preparation was immediately carried out for peanut cultivation, i.e. minimum soil cultivation and optimization of water sources (boreholes). The
peanuts planted were the red local varieties of Pemalang, Gunung Kidul and local Batang. Peanut harvesting was carried at days 68. At the end of the study, a response survey was carried out on the applied technological innovation.

The data collected were the primary and secondary data. Farmers' responses were obtained from primary data directly from the respondent using survey methods and interviews with all respondent using questionnaires. The response variables measured was CI improvement technology. While the influencing factor variables include farmer's age, education level, land ownership status, farmer status and land arable area. The assessment was carried out using the scoring method and then determined the low, medium and high responses using the Likert scale and continued with the proportion test. The hypotheses tested were Ho: P <50%; Hα: P> 50%, where Ho = it is suspected that it is less than or equal to 50% of farmers having a high response to each variable. Hα = it is suspected that more than or equal to 50% of farmers have a high response to the measured variables. Data were analyzed with a significance level of 95% (α = 0.5), n = 24 and the Z test to determine the accepted hypothesis using the following formula:

\[ Z = \frac{x - xo}{\sqrt{xo(1-xo)/n}} \]  

Annotation:
\( z \) : z score
\( x \) : mean of farmers who respond high
\( xo \) : 50% of the population
\( n \) : the number of samples

The relationship between farmer characteristics that are thought as influencing factors to the CI improvement through this technology was tested using ordinal logistic regression analysis. This analysis is a statistical method that describes the relationship between a response variable (Y) and one or more predictor variables (X), where the response variable is more than two categories and the measurement scale is level [12]. The ordinal logistic regression model can be used if it meets the following assumptions:

2.1. Parallel lines test
The hypothesis in this test is
Ho = the slope coefficient is the same for all response variables
Hα = the slope coefficient is not the same for all response variables
Statistic test:

\[ PL = -2 \ln \frac{l_0}{l_1} \sim X^2_{k(j-2)} \]  

\( l_0 \) : likelihood function with independent variables that assumes parallel lines
\( l_1 \) : likelihood function with independent variables that does not assume parallel lines

The decision fails to reject Ho when the p-value > α or when the PL value < X2 a, where k (j-2) is the number of parameters β from 1 to k and j is the number of categories of dependent variables. If the null hypothesis fails to be rejected, it means that the slope in the category of independent variables is the same and the parallel lines assumption is meet.

2.2. Simultaneous test
This test is performed to examine the effect of the β coefficient on the dependent variable simultaneously using a statistics test.

The hypothesis used is:
H0: \( B1 = B2 = ... = Bk = 0 \) (all independent variables have no effect on dependent variables)
H1: \( Bk \neq 0; k = 1, 2, ..., k \) (there is at least one independent variable that affects dependent variable)
The statistic test used is the G test statistic or the Likelihood Ratio Test. G test statistics follow the Chi-square distribution with degrees of freedom K. Here are the test statistics for test the significance of the simultaneous parameter estimator [12].

\[ G = -2 \ln \left[ \frac{l_0}{l_1} \right] \sim \chi^2_k \]  

(3)

Annotation:
- \( l_0 \): maximum likelihood value of the function without independent variables (reduced model)
- \( l_1 \): maximum likelihood value of the function with all independent variables (full model)
- \( k \): the number of \( \beta \) parameters from 1 to \( k \)

If the value of the test statistic \( G > X^2_{a,k} \) Ho fails to be rejected and the decision taken is that all variables have no effect on the dependent variable. Conversely, if the test statistic value \( G > X^2_{a,k} \) Ho is rejected so that the decision taken is that there is at least one independent variable that affects the dependent variable.

2.3. Goodness of fit test

The model used must be appropriate or meet the Goodness of Fit (GoF). A model is categorized as fulfilling the GoF if there is a match between the data entered in the model and the data observed. In Logistic Regression, the method for testing the model usually uses the Pearson, Deviance and Hosmer-Lemeshow methods. The use of the Pearson method is carried out based on the Pearson test statistics as follow:

\[ X^2 = \sum_{i=1}^{n} \frac{(O_i - e_i)^2}{e_i} \]  

(4)

Annotation:
- \( O_i \): frequency of “i” observation
- \( e_i \): frequency of “i” hope
- \( i \): 1,2,3, ...,n.

The rule of decision is that Ho is rejected if \( X^2_{hit} > X^2_{a(n-p)} \). In this case \((n-p)\) is the degree of freedom. \( n \) indicates the number of groups and \( p \) represents the number of parameters in the explanatory variable [13].

2.4. Model determination coefficient

The magnitude of the coefficient of determination in the logistic regression model is indicated by the \( R^2 \) square value.

2.5. Partial test

This test is done to test the significance of the coefficient \( \hat{\beta}_k \) partially by using the Wald test. The hypothesis in this test is:

\( Ho: \beta_k = 0; k = 1, 2, ..., K \) (the \( k \)-independent variable does not have a significant effect on the dependent variable)

\( Ho: \beta_k \neq 0; k = 1, 2, ..., K \) (the independent variable \( k \) has a significant effect on the dependent variable)

The test statistic used is the Wald test which follows the distribution \( Z_{a/2} \). The following is a test statistic to test the significance of the parameter estimator partially [12].

\[ w = \frac{\hat{\beta}_k}{se(\hat{\beta}_k)} \sim Z \]  

(5)

Annotation:
- \( \hat{\beta}_k \): the estimated value of the \( k \) in dependent variable parameter
- \( se(\hat{\beta}_k) \): the standardized error value of the \( k \) independent variable parameter
If the statistical value is \(|W| > Z_{a/2}\) or \(p\)-value < \(\alpha\) then Ho is rejected and it means that the \(k\) independent variable has a significant effect on the dependent variable. Meanwhile, if the \(p\)-value > \(\alpha\), the decision is failure to reject Ho, so the \(k\) independent variable does not significantly affect the dependent variable.

3. Results and discussion

3.1. Characteristics of farmers

The result on variables related to innovativeness was grouped into three parts that are inherent in the individual, such as socioeconomic characteristics, personality, and communication behavior. The aspect related to the socioeconomic characteristics is age, in which there is no difference between the pioneers and the last followers. Meanwhile, formal education, level of literacy, social status, social mobility, and business scale of the pioneers are higher than the last followers. In general, the response of farmers to a technology is related to the characteristics of the farmers. The characteristics of farmers (Table 1) that are considered to be the factors affecting the responses are age, education, land ownership, and area of cultivation.

Table 1. Distribution of the characteristics of the demonstration plot farmers based on age, education, land ownership, and area of cultivation.

| Characters                  | Categories                                    | Percentage (%) |
|-----------------------------|-----------------------------------------------|----------------|
| Age                         | 0 - 14 years old                              | 0.00%          |
|                             | 15– 64 years old                             | 78.26%         |
|                             | > 64 years old                               | 21.74%         |
|                             | No formal education                          | 26.09%         |
|                             | Primary School – Junior High                 | 65.22%         |
| Level of Education          | School                                        | 4.35%          |
|                             | Senior High School                           | 4.35%          |
|                             | Incorporated/Limited Company                 |                |
| Land Ownership Status       | Lease                                         | 56.52%         |
|                             | One’s Own                                    | 43.48%         |
|                             | Owner                                        | 8.70%          |
| Cultivator Status           | Owner as well as cultivator                  | 17.39%         |
|                             | Cultivator as well as tenant                  | 39.13%         |
|                             | Farm workers                                 | 34.78%         |
| Arable Land Area            | 0 hectares                                   | 8.70%          |
|                             | 0.25 – 0.67 hectares                          | 73.91%         |
|                             | > 0.67 hectares                               | 17.39%         |

The age group of the farmers ranged from 36 years to 75 years. The economically productive age is divided into three classifications (i.e. the age group of 0-14 years is the unproductive age group, the age group of 15-64 years is the productive age group, and the age group of over 65 years is no longer the productive age) [14]. Based on that, it is indicating that 78.26% of the cooperater farmers were in productive age, then it can be quickly and easily to adapt with new innovate technology. Age is one of the social factors that affect the performance of farmers in farming. The older the farmer, the lower his productivity and performance will be. According to Andi [15], the age of the farmer is one of the indicators of farming success. At productive age, farmers are easier and more willing to accept innovations that determine the success of farming so that they can increase their income. Age, profit, and price are also determining factors in the adoption of the planting system [16].
In general, the education level of farmers is still low because most of them (65.22%) are graduated from elementary schools, 26.09% of them do not have educational background, and only 8.70% of them were graduated from senior high school and higher education (Table 1). It shows that most of the farmers have literacy skills and are able to receive information that is simply conveyed and few of them can understand more about technological information. The level of education is related to the ability of farmers to adopt the technology. The higher the level of education of the farmers, the more they are expected to have more adequate knowledge and skills in farming, especially the use of new innovations. On the other hand, a higher level of education provides opportunities for farmers to choose to work outside of agriculture area, thus farming activities give more labor outside the family with the low level of education [15].

Land ownership status is related to farmers’ decision in choosing and adopting a technology. It is also related to the decision making and consideration in the lease of land and right of land use. The characteristics of farmers based on land ownership show that 66.8% of them had their own land and 33.2% of them leased the land. The roles of farmers in cultivating land are divided into four; cultivator, cultivator as well as tenant, cultivator as well as land owner, and non-cultivator. The distribution of the roles of farmers shows that the number of labor farmers was almost the same as that of the cultivating farmers, while only few land owners who cultivated their own land. On the other hand, there were few owners who employed farmers through a wage system and the decisions on land use were held by the owners. The average land ownership was not less than 0.67 ha and the largest one was 2 ha (Table 1). Land area has an effect on farm production. The wider the land, the greater the opportunity to increase production which determines the level of income and business capital. The increase in farming capital provides opportunities for farmers to adopt technology. Land ownership status also affects technology adoption [16]. Smallholders who own tenants tend to try running the farm seriously to get high yields and accept innovation compared to sharecroppers (in return for a share of the crops).

In addition, 91.67% of the cooperative farmers planted rice in the October – January period and 58.33% of the farmers had rice and corn planting pattern with rice planting in the October – January period and corn in April – June. Other farmers planted yellow cucumber on their own land in the April – June period. At least 16.67% of the farmers cultivate their land with peanuts or green beans in the July – September period after the rice and corn period. It indicates the opportunity for nuts crops to be developed in the period by farmers who own land close to water sources or have independent boreholes.

3.2. Farmers’ responses to the measured variables
Based on the data presented in Table 2, the responses of farmers to the application of technological innovation to increase the Cropping Index (CI) is high (65.22%). It indicates that they were very responsive to technological innovations applied to the success of increasing the CI. Besides, most of them were very supportive of land use in the plant period 3 (July – October 2019) for peanut farming, in which the land was left fallow in previous years.

| Technological Components | Responses (%) | Z hit/Z tab | Hypothesis |
|--------------------------|---------------|-------------|------------|
| Success of IP Improvement| High          | 65.22%      | 1.459>0.926| Success of IP Improvement |
|                          | Medium        | 20.83%      |            |
|                          | Low           | 12.50%      |            |

3.2.1. Parallel lines test. Based on Table 3, the test of parallel lines resulted in the failure decision of rejecting H0 due to the p-value = 0.895> α (0.05). Therefore, the slope coefficient is the same for all response variables with a 95% confidence level, so it can be continued with a simultaneous test.
3.2.2. Simultaneous test. Based on the Table 4, the test of simultaneous resulted in the decision to reject Ho due to the p-value = 0.032 < \( \alpha \) (0.05). It means that there is at least one of the farmer characteristic variables that affects the model with a confidence level of 95%. Model with independent variables is better than that of without independent variables.

| Model                  | -2 Log Likelihood | Chi-square | Df | Sig |
|------------------------|-------------------|------------|----|-----|
| Intercept only         | 27.511            |            |    |     |
| Final                  | 10.678            | 16.834     | 8  | 0.032 |

3.2.3. Goodness of fit test. Based on Table 5, the goodness of fit test resulted in the decision to reject Ho due to the p-value = 0.999 > \( \alpha \) (0.05). Therefore, the regression used in this test is suitable with a confidence level of 95%.

|                      | Chi-square | Df | Sig |
|----------------------|------------|----|-----|
| Pearson              | 2.743      | 16 | 1.000 |
| Deviance             | 3.558      | 16 | 0.999 |

3.2.4. Coefficient of model determination. The value of the coefficient of determination in the logistic regression model is indicated by the value of McFadden, Cox and Snell, and Nagelkerke R. square. Based on Table 6, the highest r-square value is 0.628. Therefore, the variable of the characteristics of farmers are able to elaborate the response variable by 62.8%.

|                | Sig |
|----------------|-----|
| Cox and Snell  | 0.519|
| Nagelkerke     | 0.628|
| McFadden       | 0.418|

3.2.5. Partial test. The partial test results are presented in Table 7, showing that the independent variables which significantly influence include response variables, i.e. the level of farmer education and the area of land ownership.

Based on the above equation, the farmers with the lowest education level had \( \text{Ln} \) -17.344 (odds ratio), meaning that they have a smaller chance than those with higher education level in giving good responses. Meanwhile, the farmers with middle education level had \( \text{Ln} \) -20.183, meaning that they have a smaller chance than those with higher education to give good responses. Also, the farmers without land ownership had \( \text{Ln} \) -14.758, meaning that they have a smaller chance than those with land ownership, i.e. >1.5 ha in giving good responses. The farmers with medium land ownership had \( \text{Ln} \) -18.274, meaning that they have smaller chance than those with land ownership, i.e. > 1.5 ha in giving good responses.
Table 7. Parameter estimates

| Threshold/Location | Estimate | Std. Error | Wald df | Sig. | 95% Confidence Interval |
|--------------------|----------|------------|---------|------|-------------------------|
| [Y_responses to technology = 1] | -40,744 | 7,812,009 .000 | 1 | .996 | -15,351,999 | 15,270,511 |
| [Y_responses to technology = 2] | -38,320 | 7,812,008 .000 | 1 | .996 | -15,349,575 | 15,272,935 |
| [X1_age=2] | 18,520 | 9,830,179 .000 | 1 | .998 | -19,248,277 | 19,285,317 |
| [X1_age=3] | 0* | . . | . | . | . | . |
| [X2_education=1] | -17,344 | 1,830,896 .000 | 1 | .000 | -20,930 | -13,758 |
| [X2_education=2] | -20,183 | 0.000 | 1 | . | -20,183 | -20,183 |
| [X2_education=3] | 0* | . . | . | . | . | . |
| [X3_landownership=1] | -1,966 | 78,12,009 .000 | 1 | .000 | -15,313,222 | 15,309,289 |
| [X3_landownership=2] | -5,424 | 78,12,009 .000 | 1 | .000 | -15,316,680 | 15,305,832 |
| [X3_landownership=3] | 0* | . . | . | . | . | . |
| [X4_land area=1] | -14,758 | 2,087,50,023 | 1 | .000 | -18,848 | -10,669 |
| [X4_land area=2] | -18,274 | 0.000 | 1 | . | -18,274 | -18,274 |
| [X4_land area=3] | 0* | . . | . | . | . | . |
| [X5_cultivation status=1] | 0* | . . | . | . | . | . |
| [X5_cultivation status=2] | 18,520 | 12,331,209 .000 | 1 | .999 | -24,150,205 | 24,187,245 |
| [X5_cultivation status=3] | 0* | . . | . | . | . | . |

Based on the coefficient of each variable X, the following equation can be produced:

\[
\text{Ln } [P(Y_{<=1})] = -40,744 + 17,344 \times X_{23} + 20 \times X_{23} + 14,758 \times X_{43} + 18,274 \times X_{43}
\]

\[
\text{Ln } [P(Y_{<=2})] = -38,320 + 17,344 \times X_{23} + 20 \times X_{23} + 14,758 \times X_{43} + 18,274 \times X_{43}
\]

Annotation:

Y   = responses
X_{23}  = low education level towards high farmer education level
X_{43}  = low land ownership towards high land ownership
X_{23}  = medium land ownership towards high land ownership
X_{43}  = high land ownership

4. Conclusion

The response of the farmers' demonstration plot to the CI improvement was in the high category. Characteristics of farmers that affect farmer responses are the level of education and land area. Farmers with low and secondary education have a smaller chance to highly respond to CI improvement than farmers with higher education. Farmers with a land area of 0 - 0.67 ha and 0.67 - 1.5 ha have a smaller chance to give a high response to the CI improvement than farmers with a land area of > 1.5 ha.

Acknowledgement

We thank the Assessment Institute of Agricultural Technology of Central Java - Institute of Agricultural Technology Research and Development - Agricultural Research and Development Agency - Ministry of Agriculture of Republic Indonesia for providing funds through the 2019 State Budget Bills.

References

[1] Dewan Nasional Perubahan Iklim (DNPI) 2013 *Perubahan Iklim dan Tantangan Peradaban Bangsa - Lima tahun DNPI 2008-2013* (Jakarta: Dewan Nasional Perubahan Iklim) p 149
[2] Bayu D A N and Luela N 2016 *C Agric. Agric. Sci. Procedia* 9 5463
[3] Agung B S 2016 *J. Penelit. Pertan. Tanam. Pangan* 35 29
[4] Carolyn P, Lim A H, Farrah A, Andi B R, Geetha M, Saroj K C, Giulia R, Alexandros G and Kensuke F 2020 *Water (Switzerland)* 12 119
[5] Damanhuri, Merry M D U and Dwi P S S 2019 *J. Cakrawala* 11 3347
[6] Siti S K, Mochammad N and Ninuk H 2013 *J. Produksi Tanam*. 1 8792
[7] Fransiskus X N and Syprianus C 2018 *Savana Cendana* 3 1417
[8] Wisnu U, Murti A and Yulia E S 2017 *VIGOR J. Ilmu Pertan. Trop. dan Subtrop*. 2 2833
[9] Tresliyana A and Erythrina 2012 *Widyariset* 15 19
[10] Haris S, Rima F, Yayan A and Budi K 2019 *Penerapan Inovasi Teknologi untuk Peningkatan Indeks Pertanaman* (Bogor: Balai Besar Pengkajian dan Pengembangan Pertanian) p 42
[11] BPS Kabupaten Pemalang 2017 *Pemalang Dalam Angka* (Pemalang: Badan Pusat Statistik) p 428
[12] David W H and Stanley L 2000 *Applied Logistic Regression* Second edition (New York: A Wiley-Interscience Publication) p 375
[13] Agresti A 1996 *Categorical Data Analysis* (New York: John Wiley and Sons)
[14] Ida B M 2004 *Filsafat Penelitian dan Metode Penelitian Sosial* (Yogyakarta: Pustaka Pelajar) p 175
[15] Andi Y F 2013 *Pengaruh Penggunaan Varietas Unggul Terhadap Efisiensi, Pendapatan dan Distribusi Pendapatan Petani Jagung di Provinsi Gorontalo* (Bogor: Dissertation, Institut Pertanian Bogor) p 129
[16] Abdul F, Udig R and Djoko W 2018 *J. Penyul* 14 2732
[17] Jaka S and Fatmah S I H 2017 *Inform. Pertan.* 26 99