Response and assessment of farmers on maize seed technology of Nasa 29 new high yielding varieties in Sigi District, Central Sulawesi

Mardiana Dewi, Risna, A. Irmadamayanti, A.N. Wahyuni, Syafruddin, and A.B.L Ishak
Central Sulawesi Assessment Institute of Agricultural Technology

*Email: mardianadewi11@ymail.com

Abstract. The use of New High Yielding Varieties of maize plays an important role in efforts to increase maize production. New High Yielding Varieties that introduced at the field school of the seed village self-sufficient is NASA-29. This New High Yielding Varieties of hybrid maize has many advantages, including produce double cobs with a frequency up to 70%, full seed filling on the cobs, the corncob is relatively small and hard so it is resistant to breaking when it is shelled, high yield, and the stalks is stronger. This study aims to determine the response and assessment of farmers in Sigi Regency to the seed technology of Nasa-29 New High Yielding Varieties. The study was carried out from January to December 2018 at the Langgeng Farmer Group, Kaleke Village. Respondents are farmers who carry out the field school of the seed village self-sufficient. Response data were analyzed using scoring method, to measure the importance of the NASA-29 New High Yielding Varieties’ assessment level. The method that used is The IPA method (Important and Performance Analysis). Farmers’ responses to the technology components delivered at the field school were in the doubtful to very interested category (scoring 3.00- 5.00), the highest response is harvest on time (5.00), and the lowest response is the spacing of 70 cm x 20 cm with 1 seed per hole. The results of the IPA analysis that have been obtained, it is known that not all farmers' expectations of NASA-29 attributes are in accordance with the level of importance to the production of seeds for breeders.

1. Introduction
Maize has a very strategic role in food security system and as the driver of the national economy. Aside from being a source of food for some Indonesian people, maize also contributes to the availability of protein sources because maize is the raw material for livestock and fishery feed. Maize is a puller for the growth of the upstream industry and a stimulant of the growth of the downstream industry which contributes quite significantly to the growth of the national economy. Maize is not only used as food and feed sources, but also used as raw material for other industries, such as alternative fuels (biofuels), polymers and others. The demand of maize for the food, feed, and other industrial needs in the next five years is projected to increase in line with the increasing of population and also an increase in people’s income and purchasing power [3].

Based on [2], the growth of harvested area, production, and productivity fluctuates from year to year. In Sigi Regency, maize harvest area decreased by 16.52 percent from 2011 to 2015. Besides harvest area, rice production also decreased from 2011-2015 which was 9.9 percent and Maize
productivity also experienced a decline in the same period that is down by 17.98 percent. One of the
effort to increase maize productivity is to develop New High Yielding varieties that adaptive to
specific environmental conditions. For this reason, high quality seeds are needed. The ease of
obtaining high quality seeds is an incentive needed by farmers to increase their maize production. The
Ministry of Agriculture's target in the working cabinet era is to strengthen food security by realizing
food self-sufficiency, including maize production. The Indonesian Agency for Agricultural Research
and Development (IAARD) together with all of its staff responds to the target by utilizing the results
of research and studies that have been achieved, including some of New High Yielding Varieties that
have been released. Quality seeds, both physical and systemic, play an important role in increasing
crop production. Maintaining the quality system of New High Yielding Varieties for each seed class is
carried out since before planting, planting, and during processing [11]. The use of new high yielding
seeds with hybrid and composite maize varieties in maize farming is the right strategy and absolutely
must be implemented. Empowerment of independent farmers who are members of farmer groups is a
key factor to grow the level of farmer participation in the application of maize production technology
for the realization of a sustainable national corn self-sufficiency [16]. Adoption is one of important
component that influenced the innovation-decision process. [13] states that the process trough which
an individual passes from first knowledge of an innovation to forming an attitude toward the
innovation, to a decision to adopt or reject, and to implementation and the use of the new idea.

New High Yield Varieties that introduced at the field school of the seed village self-sufficient is
NASA-29. This New High Yield Varieties of hybrid maize has many advantages, including plant
height, length and size of cob, seed filling, robustness of stems and yield potential comparable to
commercial hybrid varieties, even the length and size of cob and seed filling of NASA-29 better and
more high [1], full seed filling on the cobs, the corn cob is relatively small and hard so it is resistant to
breaking when it is shelled, high yield, and the stalks is stronger [4]. This study aims to determine the
response and assessment of farmers in Sigi Regency to the seed technology of Nasa-29 New High
Yield Varieties.

2. Materials and Methods

2.1. Study Area

The study was carried out from January to December 2018 at the Langgeng Farmer Group, Kaleke
Village, Dolo Barat District, Sigi Regency. To measure farmers' responses to the components of maize
hybrid seed production technology, interviews were conducted with 15 respondents who are
cooperative farmers that involved in the field school activities using a questionnaire. The sampling
technique was done purposively to Langgeng Farmers Group who are field school implementers.
Farmer's response was assessed by a Likert scale 1-5 with a category (not interested, less interested,
hesitated, interested, and very interested), then the response data were analyzed using scoring
(Hendayana, 2016), with the following formulation:

\[
\text{Score value} = \frac{n_i s_i}{N_i}
\]

Information:
ni : Number of respondents who stated (person) in column i (i = 1, 2, 3, …)
si : Score statement to i (i = 1, 2, 3, …)
N i : Number of respondents (person) in line i (i = 1, 2, 3, …)

To measure the importance of the NASA-29 New High Yield Varieties’ assessment level. The
method that used is The IPA method (Important and Performance Analysis). According to [7], IPA
method is one of the tools that used to analyze the level of adoption of technological innovations. This
analysis essentially uses a quadrant approach to assess effectiveness. The process is done through a
comparison between two subjects and objects or the companion and the person being accompanied
3. Result and Discussion

3.1 The response of farmers to the F1 seed production technology of Nasa-29 New High Yield Varieties

Response is the result of stimulus behavior which is the activity of the person concerned, without looking of whether the stimulus can be identified or cannot be observed. The response will be related to the stimulus, so if the stimulus occurs then a response will be taken [17]. New High Yielding Varieties of NASA-29 is the types of maize that were first introduced to the Langgeng Farmer Group, Kaleke Village, Dolo Barat District, Sigi Regency. Introduction of New High Yielding Varieties of NASA-29 was accompanied by the application of technological components in the field school of the seed village self-sufficient. According to [10], the introduction and learning of plant breeding activities to farmers is expected to help farmers in solving problems, especially in providing good quality seeds. Farmers’ responses to the technology components of the field school of the seed village self-sufficient in Sigi Regency are detailed in Table 1.

![IPA quadrant (important and performance analysis)](image-url)
Table 1. Farmers response to component of the f1 seed production technology of nasa-29 new high yielding varieties through the field school of the seed village self-sufficient in Sigi Regency, 2018

| No | Attribute                                                                 | Score |
|----|---------------------------------------------------------------------------|-------|
| 1. | 20 kg seeds per hectare                                                   | 4,62  |
| 2. | Use of labeled seeds                                                      | 4,62  |
| 3. | Pre tillage                                                              | 4,54  |
| 4. | Intensive tillage                                                        | 4,92  |
| 5. | NASA-29 New High Yielding Varieties                                       | 3,92  |
| 6. | Seed treatment                                                           | 4,46  |
| 7. | Plant spacing 70 cm x 20 cm, (1 male row, 3 female row) with 1 seed per hole | 3,00  |
| 8. | Use of leaf color chart and dry soil test kit                            | 4,62  |
| 9. | Mechanical/herbicide weed control                                        | 4,92  |
| 10.| Drainage                                                                 | 4,62  |
| 11.| Integrated pest control                                                  | 4,77  |
| 12.| Roguing                                                                  | 4,62  |
| 13.| Detasseling                                                              | 4,62  |
| 14.| Pruning before harvest                                                   | 4,38  |
| 15.| Harvest on time                                                          | 5,00  |
| 16.| Shelling with machine                                                    | 4,54  |
| 17.| Drying immediately                                                       | 4,85  |
| 18.| Sorting                                                                  | 4,72  |
| 19.| Seed labeling/certification                                              | 4,54  |
| 20.| Packaging                                                                | 4,62  |

Source: Primary data processed, 2018

Based on the Table 1, farmers’ responses to the technology components delivered at the field school of the seed village self-sufficient are in the doubtful to very interested category (scoring 3.00-5.5). The highest response is to harvest on time with a value of 5.00 (very interested), because with harvest on time will provide optimal results. According to [5], harvest and post-harvest handling will provide optimal results if the harvest is carried out at the right time and procedure (plants are harvested on physiological maturity based on plant age, water content and visual appearance of the results according to varieties description). One of the conditions for obtaining good yields of maize, among others, is adequate pant density per unit area and uniform distribution of seeds in a row [15]. Timely harvesting is a technology that is easier for farmers to implement and can be bought at a higher selling price and provides benefits for farmers. In seed production, the physiological ripe age of plants is often marked with a black layer on the seed. When plants are harvested before the black layer appears, the production of seeds produced cannot be processed by the Technical Implementation Unit of the Seed Monitoring and Certification Center to get certified seed, so the harvest in time become the most important technology of seed production. In addition, the hybrid variety of NASA 29 New High Yielding Variety also has high stay-green character, the cornhusk and upper leaves are still green even though they have entered the physiological ripe stage, so that it also can be used as animal feed with a high protein value. According to [8], this participatory cultivation technology design innovation is expected to have high and profitable innovations so that the adoption of innovations will run quickly. Along with that, [14] states that if new technology provides relatively large profits from old technology, the speed of the process of adopting innovation will run faster. The easier the new technology is practiced, the faster of the adoption process is carried out by farmers. Besides that, [12] states that the higher educational level, farm size, fertilizer access, extension services are
socioeconomic and institutional factors that would increase the probability of adoption level among farmers. Along with that, [18] states that level of adoption was determined by educational level, membership of social group, farm size, and cost of technology.

The lowest response is at plant spacing of 70 x 20 cm (1 male row, 3 female rows) with 1 (one) seed per hole with a value of 3.00 (doubtful), this is because the number of plant populations in seed production is less when compared to using male and female row ratio of 1:4 and 1:5, besides that, the farmers are not familiar with this method, where the habits of the farmers doing cultivation without using plant spacing, so this technology is considered not showing and not provided benefits. Farmers’ decision in adopting integrated farming technology innovation is influenced by the relative profit factor and the suitability of farmers to the technology delivered [9].

3.2. Level of importance and assessment of NASA 29 New High Yielding Variety

The level of importance and assessment of NASA-29 characteristics need to be carried out to determine the overall interests and assessments of farmers of the New High Yielding Varieties of NASA-29 and to determine which characteristics that need attention. From the level of importance and assessment, it will be known the extent to which the characteristics can fulfill the needs of the respondent farmers. The characteristics that farmers consider and the characters that will be discussed are production, pest resistance, growing capacity, harvest age, cob size, the number of cob, seed size/weight, seed color, plant height, seed purchase price, and maize selling price. Based on the analysis that has been done, it is known that in Quadrant I the attributes of NASA-29 are considered important by farmers but the assessment is not in line with farmers’ expectations including disease resistance, cob size, and production. Farmer valuation is lower than the level of importance. Therefore, the assessment instrument is a main priority that must be improved to match farmers’ expectations. Quadrant II, the assessment of NASA-29 attributes that included in this quadrant shows that these attributes are important and must be maintained. The attributes that included in quadrant II are the number of cobs per stem, growing capacity, age of harvest, color of seeds, buying price and selling price of maize. According to [6], all New High Yielding Varieties that have been tested, namely Bima 20 URI and NASA-29, were able to adapt well in the study location. This is indicated by the productivity of each variety that is not significantly different at 6.428 t/ha and 6.919 t/ha.

![Figure 2. Quadrant result of IPA method of NASA 29 new high yielding variety in Kaleke Village, Dolo Barat District, Sigi Regency](image-url)
The attribute of NASA-29 which is included in Quadrant III is considered to be less important and farmers' assessment of the attribute is not too special. Improvements to the attributes that included in this quadrant can be reconsidered because their effect on the assessment of farmers is very small. The attributes that include in quadran III are seed size and plant height. Based on the results of the IPA analysis that has been obtained, it is known that not all farmers' expectations of the NASA-29 attribute correspond to the level of importance to the production of seeds for breeders. The attributes of NASA-29 that accordance with the expectations of breeder farmers are the number of cobs per stem, growing capacity, age of harvest, seed color, purchase price, and selling price. [1] added that economically, the prospective NASA-29 variety is suitable to be developed with R/C ratio and B/C ratio respectively 5.1 and 4.1. NASA-29 agronomic characteristics are considered good to very good by farmers. It means, NASA-29 is able to compete with commercial varieties and has the opportunity to be developed, especially in Lamongan, East Java. In this case, it is necessary to foster seed breeders, socialization of the advantages of NASA-29 to agribusiness actors and farmer groups, and to safeguarding policies for developing national seed use.

4. Conclusion
1. Farmers' responses to the technology components delivered at the field school were in the doubtful to very interested category (scoring 3.00- 5.00), the highest response is harvest on time (5.00), and the lowest response is the spacing of 70 cm x 20 cm with 1 seed per hole
2. The results of the IPA analysis that have been obtained, it is known that not all farmers' expectations of NASA-29 attributes are in accordance with the level of importance to the production of seeds for breeders. The characteristics of NASA-29 that are in accordance with the expectations of breeder farmers are the number of cobs per stem, growing capacity, age of harvest, seed color, purchase and selling price

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