Seeding development potential and prospects of NASA 29 hybrid corn in North Sulawesi Province

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Abstract. North Sulawesi is one of the areas with great potential in supporting the production and productivity of hybrid maize seeds. The land available for the cultivation of hybrid maize seeds is very wide, the requirements for agro-climatic are simple, the technology is readily available, so that the prospect of profits for the cultivator is quite large. Most of the maize farmers in North Sulawesi tend to use hybrid seeds. This is because the yield obtained is very high, however, the availability of hybrid seeds is very limited, even if available, the price is quite expensive. Farmers are currently still dependent on seed assistance from the Government. Production of seeds through breeder farmers as a solution in order to increase corn production. NASA 29 variety is a new superior variety derived from male parents G102612 and Mal 03 as female parents. The results of the interview showed that 86% of the 25 respondents of maize farmers gave an average rating score of 3.8. This shows that they really like the characteristics of the plant. The production data for NASA 29 seed candidates is 3.6 tons / ha. These results indicate that the prospect of hybrid maize seeding business is profitable for breeder farmers.

1. Introduction

Corn commodity has a very strategic role, both in the food security system and its role as the driving wheel of the national economy. In addition to its role as food for some Indonesian people, corn is also a raw material for animal and fisheries feed. Corn contributes significantly to national economic growth because it has an economic chain from seed production, seed production to the corn-based processing industry. National maize demand increases along with the development of feed and food industries. In 2017, the need for corn for the feed industry has reached 17 million tons [7].

North Sulawesi is one of the regions with great potential in supporting the production and productivity of hybrid corn seeds. The available land for hybrid corn seedling cultivation is very broad, simple agro-climate requirements, technology is available, so the prospect of profit for farmers is quite large. Among the technological components of hybrid corn seed production, the availability of male and female parents has an important role in the production of F1 hybrid seeds. Its role is prominent both in the potential increase in yield per unit area and as a component of pest/disease control, however, superior varieties are meaningless if the quality of seeds is low. For this reason, the
selection of an appropriate superior variety, followed by quality seeds is the first step towards success in corn seedling farming.

The government has set 2018 food self-sufficiency and zero import and 2019 export targets. To achieve this, the Ministry of Agriculture has set corn self-sufficiency in 2017 with a production target of 30.5 million tons of dry shelled (PK), higher than the production achievement corn in 2016 (23.2 million tons). In response to this, the government intends to increase the total area of corn cultivation, with the target of adding 3.0 million hectares of planting area using quality superior seeds in a number of potential areas. The varieties used are required to use seeds of Indonesian Agency for Agricultural Research and Development (Balitbangtan) products as much as 40%. For this reason, it is necessary to have sufficient quantities of quality seeds, on time, and easily obtained by farmers. Balitbangtan who has released a number of superior varieties of corn, also has partners as holders of technology transfer who are expected to be able to independently produce quality seeds in the right time and the right amount.

The level of productivity that has been achieved is still relatively low when compared to the potential yields of national superior varieties. The productivity level has only reached 2-3 t/ha. The low corn production at the farmer level in North Sulawesi is due to the availability of superior seeds which are still very limited, even if there is a very expensive price, in general farmers use corn seeds from the aid of the government. To approach the achievement of the potential production of these commodities needs to be made a breakthrough in the use of new varieties of seeds that are adaptive to the area of North Sulawesi through the propagation of new varieties of seeds of superior varieties at the level of breeder farmers. One of the New Superior Varieties (NSV) with high yield potential is the NASA 29 variety produced by Research Institute for Maize and other Cereals (Balitsereal) Maros with a potential yield of 13.5 Tons/ha [3]. The purpose of this study is to provide information about the potential and prospects as well as the development of NASA 29 hybrid corn seeds in North Sulawesi Province.

2. Material and Methods

This study was carried out in a 3-hectare Farmers' Land in Paslaten village, North Minahasa Regency, North Sulawesi Province. Planting pattern 1: 4 (one male row and 4 female rows). Source of seed technology comes from Balitsereal Maros. The observed data are agronomic data of plants including plant height, cob length, ear diameter, yield, and dry seed yield. Data is collected from plots of plait by taking 10 stems of plants in each plank of 5 prepared slices. Data collection was continued on female elder plants. Data of farmers' responses to prospective NASA 29 varieties were obtained from direct interviews with corn farmers at the activity site. Economic data is calculated based on all costs of production facilities and labor in the production and post-harvest processes, as well as the economic value of the crop.

Cost and income analysis with the formula [10]:

\[ K = (Y \times Py) - (X \times Px), \]

where:

- K: Benefits (Rp / ha)
- Y: Results achieved (kg / ha)
- Py: Price (Rp / kg)
- X: Inputs used (kg or l / ha)
- Px: The price of the input unit used (Rp / kg or Rp / l).

3. Results and discussion

3.1 Geographical conditions and location of the region

North Sulawesi is located in the northern peninsula of Sulawesi Island or precisely 0° N - 3° N and 123° E - 126° E and is one of the regions located north of the equator. Topography of North Sulawesi,
there are 41 mountains with heights ranging from 1,112 - 1,995 above sea level. The lowlands and highlands in the south (from Bolaang to North Minahasa) have quite fertile soil. The climate of the North Sulawesi region is tropical, which is affected by monsoons. In the months of November to April the west wind blows that bring rain on the north coast, while in May to October changes in the south wind dry. Rainfall is uneven with annual figures ranging from 2,000-3,000 mm, and the number of rainy days is between 90 - 139 days. The area that receives the most rainfall is the Minahasa area. The average temperature is 25 °C. The average maximum air temperature is 30 °C and the average minimum temperature is 20.4 °C. Temperature or temperature is influenced by the height of a location with the calculation of each increase of 100 meters can reduce the temperature around 0.6 °C.

3.2 Level of farmers' preference

The results of direct interviews with 25 respondents of corn farmers in the germination land showed the level of farmers' preference for the prospective hybrid varieties of NASA 29 maize from plant characteristics, namely 86% gave an average rating score of 3.8. The data shows that respondents really liked the prospective of the NASA 29 variety. Following the average data of some characteristics of the NASA 29 varieties (Table 1).

| Plant Characteristics | Number of respondents 25 people |
|-----------------------|----------------------------------|
|                       | Score   | percentase (%) |
| Plant height          | 4       | 85            |
| Cob height            | 3       | 73            |
| Rooting               | 4       | 80            |
| Seed color            | 4       | 97            |
| Cob closure           | 4       | 95            |
| Average               | 3.8     | 86            |

Note: score 4 = very like, 3 = like, 2 = dislike and 1 = very dislike

The farmer's preference for a variety is determined by the advantages of that variety [7]. In experiments reported by [10] and [2], farmers choose a variety because it has high growth power (>95%), relatively cheap price, resistant to downy mildew, has drought tolerance, has high productivity, and the biomass produced remains green so that it can be used for animal feed.

| Plot | Diameters of the cob | Number of Rows | Number of seeds in a row | Cob length |
|------|----------------------|----------------|--------------------------|------------|
| A    | 40,48                | 14,00          | 26,48                    | 20,53      |
| B    | 38,05                | 12,65          | 24,26                    | 18,68      |
| C    | 38,36                | 12,93          | 24,38                    | 18,03      |
| Average        | 38,96                | 13,19          | 25,04                    | 19,08      |

Preliminary adaptation tests showed that prospective of hybrid NASA-29 corn had high yield potential with prolific potential reaching 70% [3]. The results of the determinants of corn productivity indicate that the climate in Indonesia is not an obstacle in the corn production business so that the expansion of the planting area can be done on various types of land [12].
3.3 Development prospects

Financial analysis shows the income of farmers who plant NASA-29 is higher compared to farmers who grow commercial hybrid corn with a difference in the range of Rp 2-3 million/ha. The economic benefits of corn farming using NASA-29 reached Rp29 million/ha, while the use of other varieties ranged from Rp26-28 million/ha. Analysis of the profitability and feasibility of farming shows that the development of prospective NASA-29 varieties is more profitable and more feasible than other varieties. The value of R/C ratio and B/C ratio of prospective farming varieties of NASA-29 reached 5.1 and 4.1, respectively. An R/C ratio of 5.1 means that the farmer receives IDR 5,100 in each use of IDR 1,000.

According to [7], farmers' preferences or choices for a variety are determined by the advantages possessed by certain varieties. NASA-29 has the characteristics of a large and long cob with a diameter of small lumps, thus giving higher yields [4]. Hybrid varieties are superior varieties of plant breeding results that are proven to be able to produce 15% better than open-bred varieties [8].

Corn production in Indonesia in 2013, 2014 and 2015 amounted to 18.51 million tons, 19.01 million tons and 19.61 million tons with productivity of 4.84 tons per hectare, 4.95 tons per hectare and 5.18 tons per hectare, and harvest area of 3.82 million ha, 3.84 million ha and 3.79 million ha [11]. Based on data from the Central Statistics Agency it can be seen that every year efforts are always made to increase production and productivity to achieve production targets the following year. One effort that can be done in increasing corn productivity is the use of quality seeds. Efforts to improve the quality of seeds become an important part in increasing the competitiveness of hybrid corn seed products. However, until now, domestic corn seed resources and institutions have not been capable and competent agricultural producers [5].

4. Conclusion

North Sulawesi Province has potential, as well as prospects in order to develop NASA hybrid corn seed 29. The results of direct interviews with 25 respondents of corn farmers in the germination land indicate the level of farmers' preference for prospective NASA hybrid corn varieties 29 from plant characteristics that is 86% giving an average rating score - 3.8 average. The data shows that respondents really liked the prospective NASA variety 29.

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