Implementation and farmer perception of corn seed production technology in Southeast Sulawesi

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Abstract. The availability of good quality seeds is an important factor for increasing national corn production. To ensure the availability of quality corn seeds from superior varieties produced by the IAARD, a dissemination model was carried out through the Corn Seed Independent Field School program. This paper aims to determine the implementation of independent corn seed field schools and farmers' perceptions of seed production technology in Southeast Sulawesi. The results of research were (1) Corn Field Independent School as a concept for the dissemination of corn seed production technology has provided a change to the increase of knowledge and skills to farmers regarding the technology of corn seed production (hybrid) (2) The activities of independent corn seed field schools have grown the institution of formal corn breeders in Konawe Selatan District and have succeeded in producing quality seeds that have passed certification (3) Perception analysis was obtained, from the business aspect of corn seed production, 88% of farmers gave a positive perception, as well as farmers' perceptions of technological characteristics, there were 95% of farmers providing a positive perception. This shows that the technology of corn seed production has the opportunity to be cultivated and further developed.

1. Introduction
Corn is an important food commodity that demand continues to increase. Corn is a commodity that has good national competitiveness [1] During the period of 2006 - 2015 domestic demand for corn increased with a growth of 6.40 percent [2] In the same period, national corn production also increased by 6.31 percent [3] One of the triggers for the high demand for corn is to meet the needs of corn for the feed industry which has reached 50% of the total national maize needs [4]

To meet the national demand for corn, the government created some efforts to increase production, even though faced several obstacles, including the availability of good seeds [5,6]. There are still many farmers who use seeds from the previous crop harvesting season because the price of seeds is expensive [7] provision of high yielding quality seeds plays an important role in determining the level of results obtained and accelerates efforts to increase national maize production [8,9,10]. The contribution of good seeds in an effort to increase the number and quality of national corn production very important.

Since 2015, government initiated Farmer Field School of Independent Corn Seed program. This program try to socialize and disseminate seed production technology from researcher to farmer. The independent corn seed field school is considered a very strategic model in supporting the provision of quality seeds through the transfer of corn seed production technology through various stages of training until the technology is applied on farmers' land [11,12].
The technology of corn seed production delivered to farmers through the independent corn seed field program is a new innovation for farmers in Southeast Sulawesi. For this reason, it is necessary to know how farmers perceive the technology, and how the implementation of independent corn seed field schools, especially in Southeast Sulawesi. This paper tries to propose the implementation of independent corn seed field schools and measure the farmers' perceptions of seed production technology in Southeast Sulawesi.

2. Methodology
The research was conducted in August 2016, in Pangan Jaya Village, South Konawe Regency. To determine farmers' perceptions of corn seed production technology, data was collected through interviews with 30 farmers that involved in Farmer Field School of Corn Seeds program. Questionnaires of farmers' perceptions are arranged using the Likert scale [13], compiled by describing the indicators of observation into statement items.

Farmers' perceptions of corn seed production were carried out on two aspects of observation, namely (1) farmers' perceptions of hybrid corn seed production efforts and, (2) farmers' perceptions of the characteristics of hybrid corn seed production technology. For the purposes of analysis, each statement is scored according to the choice of the respondent [14], with the following formula:

\[ X_i = \frac{n_i}{N} \times 100\% \]

Information:

- \( X_i \) = Farmer's perception
- \( I = 1,2,3,...,n \)
  - 1 = perceptions of farmers who agree
  - 2 = doubtful farmers
  - 3 = farmers who disagree / refuse
- \( n_i \) = Number of farmers who agree / doubt / refuse
- \( N \) = The total number of farmers (people)

3. Results and Discussion

3.1. Characteristics of Farmer Field School of Corn Seed Production in Southeast Sulawesi
Farmer characteristics such as age, formal education, farming experience, land ownership area, and availability of family labor are internal conditions of farmers that can influence farmers' considerations in applying recommended technology (corn source seed production). Farmers' internal conditions can also be a determining factor that influences the level of success in developing and supporting the production of corn sources. Following are the characteristics of farmer breeders cooperating in the Field of Corn Seed Independent Village School activities.
Table 1. Characteristics of farmer respondents in the field of corn seed production in Southeast Sulawesi, 2016

| Farmer's characteristics    | Percentage | Average |
|-----------------------------|------------|---------|
| Age (year)                  |            |         |
| - 15 - 55                   | 100        | 47      |
| - > 55                      | 0          |         |
| Education                   |            |         |
| - 6 years (primary school)  | 12.5       |         |
| - 9 years (junior high school) | 25.0   |         |
| - 12 year (senior high school) | 37.5 |         |
| Farming experience (year)   |            |         |
| - <10                       | 25         |         |
| - 10 – 20                   | 75         | 10      |
| - >20                       | 0          |         |
| Number of family dependents |            |         |
| - 1 - 2                     | 0          |         |
| - 3 - 4                     | 80         | 4       |
| - > 5                       | 20         |         |

3.2. Implementation of Farmer Field School of Corn Seed Production in Southeast Sulawesi

Southeast Sulawesi Province is one of the potential areas for maize development, which has area around 68.14 ha with productivity reach only 2.8 t/ha [15]. This productivity still below with the potential of corn productivity reaching that can reach 8.4 to 11.7 t/ha [16]. The low yield obtained is due to the lack of optimal application of technology at the farm level, especially the use of superior / quality seeds. The realization of formal corn seed production in Southeast Sulawesi is slow. The number of seed producers is currently only 4 breeders (seed producers) with the production of 24 tons of certified seeds [17]. Several obstacles that seeder faced are difficult to get field school seeds level and low skills of farmers in corn breeding.

Developing farmer groups of seed breeders in rural areas that are built based on the model of community-based seeding systems is one effort to provide quality seeds by farmers independently. Farmer Field School approaches used to implement seed production technology in farmer level, so farmer can learning by doing about seed production technology direct from researcher or extensionist or other farmer that have experience in seed production [18].

The development of farmer field school seed production model involves several institutions that have duties and responsibilities respectively, namely: (1) Food Crop Research and Development Center, has responsible in planning and proposing funds, compiling general guidelines and coordination, (2) Center for Research and Technology Development, responsible for planning and proposing funds and coordinating Assessment Institute for Agricultural Technology (AIAT), (3) Research and Development of food crops, have duty and responsible in providing technology, seed sources, technical guidance, researchers as resource persons (trainers), technology assistants and, (4) Agricultural Technology Research and Development Center, having duties and responsibilities in carrying out seed production field schools.

Farmer Field School of corn seed production in Southeast Sulawesi conducted since 2016 in South Konawe Selatan Regency, which some activities such as: developing corn seed breeders, technical guidance training in seed production technology and hybrid corn seed production. FFS of corn seed succeeded in increasing farmers' knowledge and understanding in producing corn seeds, especially hybrid corn seeds (Table 2).
Table 2. Level of farmer knowledge of seed production technology hybrid corn in Southeast Sulawesi, 2016

| The Technology of hybrid corn seed production | Knowledge of Farmers (%) |
|----------------------------------------------|---------------------------|
|                                              | Before | after |
| Land preparation                             | 0      | 100   |
| Selection of varieties and needs of seeds    | 0      | 100   |
| Planting                                     | 0      | 100   |
| Fertilizing                                  | 78     | 100   |
| weeding and piling                           | 90     | 100   |
| Control of pests and diseases                | 90     | 100   |
| Plant selection/roguing                      | 0      | 100   |
| Extraction of male flowers on female parent plants | 0      | 100   |
| Destruction of male plants                   | 0      | 92.5  |
| Harvest and seed processing                  | 20     | 95.00 |
| Average                                      | 27.80  | 98.75 |
| Changed                                      | 70.95  |       |

Table 1 shows that farmers' knowledge of corn seed production (hybrid) already changes, which can be seen from the increase in knowledge of 70.95%. This is perceived as an increase in farmers' knowledge about the techniques of hybrid corn seed production after the existence of field activities of corn seed production. Furthermore, the level of technology implementation is presented in Table 3.

Table 3. Level of application of seed production technology hybrid corn in Southeast Sulawesi, 2016

| Hybrid corn seed production technology | Level of application of technology (%) |
|---------------------------------------|----------------------------------------|
|                                       | known          | applied          |
| Land preparation                      | 100            | 92.5             |
| Selection of varieties and needs of seeds | 100          | 100              |
| Planting                              | 100            | 100              |
| Fertilizing                           | 100            | 92.5             |
| Weeding and piling                    | 100            | 87.5             |
| Control of pests and diseases         | 100            | 100              |
| Plant selection/roguing               | 100            | 100              |
| Ewers on female parent plants         | 100            | 100              |
| Destruction of male plants            | 100            | 87.5             |
| Harvest and seed processing           | 100            | 87.5             |
| Average                               | 100            | 94.75            |

The Table above shows, most of the components of hybrid corn seed production technology (94.75%) have been applied by farmers. However, there are technological components that have not been properly implemented, namely: land preparation, fertilization, weeding piling, destruction of male plants and processing of seeds. Through the independent corn seed field school, it has also succeeded in introducing hybrid varieties of Bima 20 URI maize and produced 10 tons of corn seed that has certificated. The details are shown in Table 4.
Table 4. Results of production of hybrid corn seeds through the independent corn seed field school in Southeast Sulawesi, 2016

| Information                                                                 | Amount (kg) |
|-----------------------------------------------------------------------------|-------------|
| Seed class                                                                  | FS          |
| The Average yield of prospective seeds (kg / ha)                            | 2430        |
| Number of seeds tested BPSB (kg)                                            | 10,000      |
| Number of seeds passed certification (kg)                                   | 10,000      |

Seed distribution:

The Internal village, outside the village, sub-district and district: Konawe, Kolaka, Muna and Konawe Selatan.

The Table 4 shows, the FFS of corn seed production program in Southeast Sulawesi has succeeded in transferring technology, knowledge and skills to farmers in producing quality corn seeds and certification. Besides that FFS corn seed has also succeeded initiate and growth of institutional corn seed breeding groups in South Konawe Regency. One of Seed Producer group is “Citra Sari”. Now Citra Sari group managed to produce corn seeds around 21 tons of corn seed certificated consist of some varieties such us Bima-20 URI 2 tons, Lamuru 5 tons and Sukmaraga 14 tons.

3.3. Farmer’s Perception Of Corn Seed Production Technology

Farmers perceptions of technology will affect farmers’ acceptance of these technologies perception is a key factor that influences farmers’ appreciation of technological innovation [19]. Furthermore, the process adoption of innovation influenced by the characteristics or characteristics inherent in the innovation[20,21]. Perception is interpreted as a response or interpretation of farmers to corn seed production technology, which is assessed based on two aspects of observation, namely: (1) farmers’ perceptions of corn seed production business and (2) farmers’ perceptions of the characteristics of corn seed production technology.

Farmers’ perceptions of maize seedling (hybrid) business shows that the majority of farmers (88.56%) provide a good (positive) perception of corn seed breeding efforts (Table 5).

Table 5. Farmer perception of corn seed production business in Southeast Sulawesi, 2016.

| Statement                                                                 | Perceptions Of Farmers (%) |
|--------------------------------------------------------------------------|---------------------------|
| Farmers are very interested in the hybrid corn seed breeding business     | Agree: 71.4, Doubt: 28.6, Disagree: - | Total: 100 |
| farmers are interested in becoming independent corn seed producer         | Agree: 71.4, Doubt: 14.3, Disagree: 14.3 | Total: 100 |
| Hybrid Corn seed production business more profitable than corn consumption | Agree: 100, Doubt: - | Total: 100 |
| Market availability is an important factor in the sustainability of corn seed production business | Agree: 100, Doubt: - | Total: 100 |
| The technology of hybrid corn seed production is well understood by farmers | Agree: 100, Doubt: - | Total: 100 |

| Average                                                                   | 88.56, 8.58, 2.86, 100 |

The Table shows that the most of the respondents have a good perception of corn seed production business. They believe that corn seed production have potential economic now and for long run, because corn still became a strategic commodity that has demand continuously increased, so the demand for corn seed also increased. Eventhough several farmers still doubt about this business,
because of corn seed business still new for them. Based on the characteristics of the technology of corn seed production (hybrid), farmers' perceptions indicate that corn seed production technology can be adopted more widely by farmers because it meets the technological criteria, namely (1) relative advantage (2) compatibility (3) complexity (4) ability to be tested and (5) observed ability. Farmers' perceptions on characteristics of corn seed production presented in Table 6.

**Table 6. Farmers perception for technology characteristics of corn seed production in Southeast Sulawesi, 2016.**

| Statement                                                                                        | Farmer Perception(%) |
|-----------------------------------------------------------------------------------------------|---------------------|
| The technology production of hybrid corn seed has a relative advantage                        | 100                 |
| The technology of hybrid corn seed production has compatibility with applicable values and farmers' needs | 100                 |
| Some of the technology production of hybrid corn seed difficult to understand and apply         | 75                  |
| The technology of hybrid corn seed production can be tested demonstrated                        | 100                 |
| The technology of hybrid corn seed production can be observed                                  | 100                 |
| Average                                                                                        | 95                  |

Table 6 shows that, based on excellence criteria, there are relatively 100% of farmers giving agreed statements that seed breeding technology has an advantage over previous technology (feed corn), which can be seen from increased economic benefits. Analysis of farm income shows that if the corn seed production business (hybrid) has a profit of Rp. 27,155,000 while the previous farming (feed corn) amounted to Rp.6,690,000. These results indicate that the corn seed production business has better economic benefits than the previous farming [22]. The single most decisive factor in generating enthusiasm for a program is an increase in income. This has a certainty when viewed from the income earned by farmers, where seed breeding businesses provide better income than consumption corn [23].

Based on the criteria of compatibility, 100% of farmers gave a perception agreeing with the statement that the technology of hybrid corn seed production was deemed to have conformity to the technologies and patterns of agriculture that were previously valid, and the needs of adopters. Compatibility is the suitability / harmony between innovations that are introduced with (a) pre-existing technology, (b) prevailing agricultural patterns, (c) social, cultural, farmer beliefs, (d) previously introduced ideas, and (e) needs felt by farmers [24]. Next based on the criteria of complexity, farmers' perceptions show that 75% of farmers agree that hybrid corn seed breeding is not complicated, or easy to understand and apply. However, there are 25% of farmers who doubt that captive technology can be easily implemented. The complexity is the level at which an innovation is considered relatively difficult to understand and use [25].

The ability to be tested is the degree to which an innovation can be tested at a certain level or on a small scale. Usually if a new innovation is received it still raises doubts for farmers to immediately implement it / adopt it. Based on these criteria, perceptual analysis shows that as many as 100% of farmers give an agreed opinion, that seed breeding technology can be tested or demonstrated on a small scale, thereby reducing farmers' doubts to adopt the technology. Ability to be observed (observability) is the degree to which the results of innovation can be seen by others [20]. In other words, a new innovation will be more easily adopted when the effect or the results are easy or fast to be seen and observed by other farmers. Based on these criteria, the analysis of farmers' perceptions shows that 100% of farmers agree with the statement that hybrid corn seed production technology can be observed. Thus the technology of corn seed production is easily seen and observed by other farmers.
farmers, so that other farmers can imitate and imitate the new technology without needing to ask other farmers.

From the analysis of farmers' perceptions, it can be concluded that most farmers provide a positive perception of hybrid corn seed business (88%) and the characteristics of hybrid corn seed technology (95%). This means that the technology of corn seed production is very likely to be cultivated and developed more widely at the level of farmers / prospective breeders. With the development of seed breeding at the farm level, the need for corn seeds can be guaranteed independently, and from their own territory. On a broader scale it can contribute to the supply of quality superior corn seeds in Southeast Sulawesi.

For the development of breeding corn seeds in the future, and so that seed production can be sustainable, it is necessary to initiate a partnership and collaboration with local governments or seed producers (BUMN / Private) in the marketing of seed products. This is a very important requirement for farmers, because the availability of the market will provide motivation for farmers to continue to produce corn seeds, so that seed production can continue to be carried out continuously. Market availability will also provide opportunities for the growth and development of new seed producers, and ensure the sustainability of farmers to conduct seed production efforts independently.

4. Conclusion
Seed independent field school is one model to disseminate corn seed production technology. This model provided a change to the increase of knowledge and skills to farmers regarding the technology of corn seed production (hybrid). The activities of corn seed independent field schools have grown the institution of formal corn breeders in Konawe Selatan District and have succeeded in producing quality seeds that have passed certification. Perception analysis was obtained, from the aspect of the business of corn seed breeding, 88% of farmers gave a positive perception, as well as farmers' perceptions of technological characteristics, there were 95% of farmers providing a positive perception. This shows that the technology of corn seed production has the opportunity to be further developed.

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