Farmers’ preferences for composite corn in dry land area of Central Sulawesi

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Abstract. The success of a product is whether the product or technology is accepted by the user/consumer. To bridge the gap between breeders and farmers and to ensure that new varieties satisfy farmers’ preferences and suitable to the its socioeconomic situations, a study of farmers’ preference is needed. Therefore the study aims to know the preference and the feasibility of the composite corn in Central Sulawesi. The introduction composite corn consist of Srikandi Kuning, Lamuru, Sukmaraga, and Anoman which were applied in Kaji Terap Program. A survey had been conducted to users in Parigi Moutong and Sigi District Central Sulawesi, and a quantitative and descriptive analysis approach were employed in this study. Proportion analysis was used to measure the general preferences of farmers as user while the detail perception was calculated using scoring method. The findings show that more than 50% users in dry land have high preference to composite corn for some characteristics namely: productivity, drought, diseases resistant, grain color, market preferences, and number of corncob. Anoman which has high productivity but has lower preference because of its color does not suit with the market’ preference.

1. Introduction
Corn is one of the main food crops in Indonesia which has an important role in the economy. Apart from being a food ingredient, corn also has multiple functions as raw material for animal feed, industrial raw materials, and alternative biofuel fuels [1]. National corn demand increases every year along with the increasing population. The increasing demand for corn must be followed by increased production and productivity. In recent years, corn production has shown a prominent growth rate and has made a significant contribution to the growth of the national economy.

The national corn productivity in 2005 was 3.45 ton, dry shelled, and it was 4.21 ton in 2009, or an increase of 4.78%, on average [2]. The increased corn production for the last few years is still unable to meet domestic corn demand; thus, breakthroughs in ready-made technology innovation are required to increase domestic corn production [3]. Current corn productivity of Central Sulawesi reaches 4.1 ton/ha [4]. This number is lower than previous research result from Indonesia Cereal Research Institute (ICERI), Maros on hybrid corn and composite corn varieties using corn PTT-approach technology where its production could reach 7-9 ton per hectare [5].

The price of hybrid corn seed at the market is relatively high while the farmers’ purchasing power is low, thus it will have an impact on productivity. Therefore, composite corn becomes an alternative for farmers as it has an affordable price and suitable for marginal lands including dry land. Despite of its lower fertilizer dose input, the composite corn is still able to grow well compared to hybrid corn that uses higher inputs in marginal land. The agricultural research and development agency through
ICeRi has produced composite corn varieties, such as Lamuru, Srikindi kuning, Sukmaraga, and Anoman. These varieties have the following superiorities: (1) it can be planted repeatedly compared to hybrid corn based on its source seeds, (2) it is tolerant to drought, (3) it could grow well in marginal lands, (4) it requires lower fertilizer dose input application compared to the hybrid, and (5) it requires less water in an area with lack of water compared to the hybrid corn [6].

The expanded cultivation of corn over dry areas should be considered as a very reliable alternative staple food-source compare to rice, since corn may provide benefits in terms of food security and functional compounds for local diets with lower water demands. [7]. Central Sulawesi, especially Sigi and Parigi Moutong districts have a spacious potential dry land for corn development. Due to its superiorities in marginal land, the composite corn has a potency to be developed in both districts. However the development of corn needs a recommendations of several adaptive composite corn varieties which were applied from Kaji Terap Program. Kaji Terap Program consist of both assessment and extension which were more effective in dissemination, as one of researched result stated that dissemination which involved extension and research were much faster in spreading the technology [8]. Furthermore, preferences in choosing varieties could be primarily based on communication of farmers to extension agents or researchers [9].

There are several options of composite corn varieties that presumably suitable to be developed in dry land and will be acceptable and adopted by farmers in Central Sulawesi. However, those varieties should meet the needs and preferences of farmers including market preferences in order to be accepted by farmers as consumers. Therefore, the research aims to know the preferences of farmers toward composite corn in dry land area of Central Sulawesi especially in Sigi and Parigi Moutong Districts.

2. Material and Methods

The study used primary and secondary data. Primary data were conducted by survey on 50 respondents of farmers, used simple random sampling method in 2019. The study conducted in two sub District in Sigi district and four sub district in Parigi Moutong District. In those sub-district there were application assessment which used composite corn. Those sub district in Sigi consist of Nokilalaki and Dolo Barat while sub district in Parigi Moutong consist of Amphibabo, Kasimbar, Sidoan, and Tomini. The data were analyzed by statistical and descriptive method. Proportion analysis was used to measure the preferences farmers toward composite corn. Hypothesis for farmer to composite corn are:

H0 : P ≤ 50%
H1 : P > 50%

H0 : Being expected that less than or equal to 50% farmers in Parigi Moutong and Sigi district have high preferences to composite corn in dry area of Central Sulawesi
H1 : Being expected that more than 50% farmer in Sigi have high preferences to composite corn in dry area of Central Sulawesi.

The significance level is 0.05, used formula:

\[ Z_{hit} = \frac{\bar{X} - P_0}{\sqrt{\frac{P_0(1-P_0)}{n}}} \]

The perception of farmers to each characteristics of corn were evaluated used scoring method (Hendayana, 2016). The scoring method used Likert Scale for measurement. The value range of respondents’ closed response was 1 – 5 from positive statements (expected responses) with a score of 5 up to negative statements (unexpected response) with a score of 1.

The score value calculation used the following formula.

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

\( n_i \) = the number of respondent who stated in column i \((i = 1,2,3, \ldots 5)\)

\( s_i \) = score of statement i \((i = 1,2,3, \ldots 5)\)

\( N_i \) = the number of respondent in row i \((i = 1,2,3, \ldots 5)\)
3. Results and Discussion
Most breeders of improved corn seed varieties have focused on raising yields, as well as addressing drought and disease tolerance. However, farmers perceive little advantage from such improvement because such seeds are not designed for their need. It is, therefore, imperative to develop corn seed varieties which also accommodate attributes that are preferred by farmers. Improving corn breeding processes cannot be accomplished without the knowledge of attributes that farmers prefer in corn or any other variety. For effective breeding, farmers’ preferences for varieties should be clearly identified through researcher-farmers interactions and collaboration [10].

Drought and the risk associated with it still to be formidable challenges for rain-fed corn production or water-scarce areas in Central Sulawesi. Therefore, the development of crop technologies that reduce the vulnerability of farming because of droughts is essential. Along with water conservation and soil management, drought-tolerant corn is a key option available to farmers as a protection against drought [11]. In Kaji Terap program, the composite corn was applied in rainfed or water-scarce area in Central Sulawesi. However due to the market aspect and the other traits of corn, the preferences of corn should be consideration. General preferences of composite corn in Kaji Terap area is presented in Table 1.

Table 1. Summary proportion test on Farmers perception to composite corn in Central Sulawesi.

| Null hypothesis                                                                 | Significance level | Proportion test significance | Decision  |
|---------------------------------------------------------------------------------|-------------------|------------------------------|-----------|
| Being expected that less than or equal to 50% farmers in Parigi Moutong and Sigi have high preferences to composite corn in dry area of Central Sulawesi | 0,05              | 0,000                        | Reject Ho |

Generally farmers in two districts are significantly have high preferences in characteristics of composite corn. It shown in the proportion test is 0,000 or lesser than significance level 0,05. It means that H0 was rejected or means that more or equal to 50% sample of farmers have high preferences to composite corn. Composite corn has superiority which is still able to get good productivity in dry area [6]. Cultivation of composite corn has the potential to secure and sustain livelihood of stake holders under dry land conditions. Some facts that improved composites corn have raised the livelihood status of farmers which were cultivating corn under dry land conditions [12].

Productivity as one indicator of farmers’ preference as one research’s result stated that key characteristics affected farmers' adoption decisions as well as the productivity [13]. Some other traits also become reasons of preferences on choosing composite corn. Some traits on staple food preferences such as purchase price, disease resistance, drought tolerant [14]. Furthermore, larger grain sizes, higher yield levels, and a reduced maturation period Gamboa et al (2018) as point in choosing variety. Other research stated that the characteristics of farmer preferences is cob size, grain size, number of line, drought tolerance, diseases resistance, yield [16].

Postharvest traits such as grain cooking quality and taste are factors that strongly influence the degree of adaption and duration of use of varieties which mainly purpose for staple food. Thus, the breeders should consider eating and cooking qualities of the new lines/varieties [17]. Some farmers in Central Sulawesi also has interest to make corn rice from composite corn because of its texture. However, since the main purpose of corn is for feed therefore the postharvest traits were excluded.

Moreover, consumers and traders’ preferences are important to the extent that farmers produce corn not only for themselves but also for the market. The results have revealed that before making decisions to buy corn, consumers pay more attention to quantity-related attributes (such as grain size and kernel density). When dealing with staple foods such as corn, breeders should focus on quantitative traits whereas both quantitative and qualitative traits should be considered for non-staple food crops [18]. Based on those references, the study used some traits as consideration of farmers to choose corn varieties especially in dry land which shown in Table 2.
Table 2. General farmers’ preferences of composite corn in Sigi and Parigi Moutong Districts

| Description                        | Score |
|------------------------------------|-------|
| Grain color                        | 3.98  |
| Number and size of corncob         | 4.16  |
| Market preferences                 | 3.94  |
| Productivity                       | 4.06  |
| Resistance to plant diseases       | 3.88  |
| Resistance to drought              | 4.32  |

In general farmers have preferences to composite corn, which shown in Table. 2. The scores are higher than average score (3). The characteristics which were preferable to farmers were the drought tolerant, productivity, and number and size of corncob. Other characteristics were still higher than average (more than three) but less than four.

The result of preferences on corn composite was almost similar with preference on corn generally. Farmer preferred a high-yield variety, resistance to diseases, and corn with bigger cob size. Farmers are willing to adopt a variety only if it includes attributes that represent their preferences. The higher yield also implied that the improvement of crops and the adoption of the improved varieties in these communities might be feasible [19]. This is in line with research whch was stated that yield is an important factor that can influence the use of improved maize seed variety among farmers. The results showed that harvested yield positively and significantly influenced the likelihood of farmers using improved corn seeds varieties [10]. The productivity and other agronomic data was shown in Table 3.

Table 3. Agronomic data of four composite corn in Kaji Terap Program in Central Sulawesi

| Variety   | Plant height (cm) | Number of leaves | Cob length (cm) | Diameter (mm) | Cob weight (gr) | Productivity (ton) |
|-----------|-------------------|------------------|-----------------|---------------|-----------------|--------------------|
| Anoman    | 217.9             | 14.3             | 17.89           | 47.73         | 208.58          | 6                  |
| Sukmaraga | 192.6             | 13.3             | 18.28           | 45.27         | 188.62          | 7                  |
| Srikandi Kuning | 208.9           | 13.8             | 19.88           | 51.93         | 211.16          | 6                  |
| Lamuru    | 180.3             | 11.5             | 17.55           | 48.10         | 201.156         | 7                  |

Composite corn has the opportunity to be developed in dry land, not only because the yield is high but also adaptive to environmental stress conditions (drought) [20]. High productivity makes a high preference of farmers too [21]. The productivity of composite corn are around 6-7 ton per hectare while based on baseline data, the average productivity in dry land with non-intensive farming is 4 ton per hectare. However, the productivity of composite corn is still below of general hybrid corn. These fact suitable with researched of Hastini & Noviana (2020) that the same of fertilization treatment the hybrid corn is higher than composite corn. However, composite corn has many advantages. The advantages include the seeds having better growth power, cheaper seed prices, downy mildew resistant plants, drought tolerance, and higher productivity [23].

Corn production in the two zones is constrained by a variety of related factors, the extent of contribution of each factor varies across the districts [24]. It also happened in two area in Sig Districts where the hard rained in the Nokilalaki sub-district made the higher incident of diseases therefore the aspect of diseases resistant was different between the area. Furthermore if we go to farmers preference to each varieties, it will considered of many aspect including the market preference which can be shown in Table 4. The price farmers were willing to pay for corn seed not only depended on quality attributes, but also on seed market prices. These have important implications for policy makers to streamline production, multiplication and distribution of high quality corn which also market oriented. [25].
Table 4. Scores of four composite corn traits in Parigi Moutong and Sigi Districts

| Traits                      | Srikandi Kuning | Lamuru | Sukmaraga | Anoman |
|-----------------------------|-----------------|--------|-----------|--------|
| Grain color                 | 3.98            | 3.4    | 3.4       | 2.98   |
| Number and size of corncob  | 3.88            | 4.06   | 4.06      | 3.96   |
| Market preferences          | 4.16            | 4.06   | 3.98      | 2.88   |
| Productivity                | 4.06            | 4.26   | 4.16      | 4.06   |
| Resistance to plant diseases| 3.88            | 3.96   | 3.64      | 3.98   |
| Resistance to drought       | 4.06            | 4.16   | 3.98      | 3.98   |

One fact that farmer preferences based on market preference was the preference to Anoman grain color which in line with market preferences. Anoman variety has white color grain which is not preferable for market. Since the corn is mainly purposed for feed which preferred yellow or orange color. Thus the anoman have low score on grain color and market preferences. The Srikandi Kuning has highest preference on color of grain. Its color was liked by chicken breeders for the egg production. While the number and cob size were relatively the same.

The final decision to adopt a new idea or package of technology is usually the result of a series of influences operating through time. While it is believed that adoption of technology would give higher yield on a farmer’s field, the identification of different factors that affect the farmer’s decision to adopt or not a certain practice is still need to be studied [26]. Quality traits such as high dry matter content of storage roots and early maturity were important attributes also [27]. Other studies have also documented that farmers’ choices are often rational, even though they may not make sense from a purely economic perspective [28].

4. Conclusion
Farmers in Parigi Moutong and Sigi Districts in Central Sulawesi significantly have preferences on composite corns which were introduced in Kaji Terap Program. The traits which were prefered by farmers were drought tolerant, plant diseases tolerant, grain color, and productivity. Among four composite corn namely Srikandi Kuning, Anoman, Sukmaraga, and Lamuru, anoman has the lowest preference because of its color which not market preferable.

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