Characterization of Siarang Dairi local corn, Regency of Dairi, North Sumatera Province

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Abstract. Corn is one of the carbohydrate-producing plants in addition to rice and wheat which contains nutrients that can be used for humans and animals. Local plants have an important role for genetic resources and can create new varieties. So it needs to be preserved and utilized. The purpose of this research is to characterize the local maize of Siarang Dairi. This research uses qualitative method is descriptive analysis. The data collected include the quantitative and qualitative character of agronomic and morphological characters using 5 plant samples. The results showed that the local Siarang Dairi maize had a root falling percentage of 0% and the stem fall percentage of 3.07%. The high of the plant ranged from 236 - 277 cm. The length of the cob were from 16 - 19 cm with an almost homogen diameter of 4 – 4.5 cm. The uppermost form of cylindrical and cylindrical conical. Grain lengths range from 6 - 8 mm, with grain widths ranging from 5 - 9 mm, and grain thicknesses ranging from 3 - 5 mm. The top grain surface shape is jagged, round, and flat. Specific color grains are unique and varied from brown, orange and red color.

1. Introduction
Corn is one of the 7 (seven) main commodities targeted by the Ministry of Agriculture in achieving self-sufficiency program and increasing production in 2017. In 2015, North Sumatra has corn harvest area of 243,772 ha with production of 1,519,407 tons. One of the districts with hybrid and local corn potential is Dairi with harvested area of 39,261 ha and production of 259,033 tons [1].

In the 90's until now, corn commodities began to grow rapidly and interest farmers in Indonesia. Government agencies, especially the Directorate General of Food Crops through a Special Effort program of corn commodities will expand Indonesian Agency for Agriculture Research and Development products throughout Indonesia, whether integrated with palm or soybean. Private companies are also starting to compete for corn development across the archipelago with the latest technology. So that more and more technological findings to create a commercial corn and create concern in disappearance of local varieties quality that are adaptive in certain areas.

The local corn of Siarang Dairi grown in Dairi district, especially in Sidikalang, Parbuluan, and Sumbul subdistricts has different characteristics from maize which is more commonly known to the common farmers. The Siarang Dairi local corn has a harvest time of about 5-6 months of the year and has different color characteristics in 1 corn cob because it is free sided maize. The varieties of free-sided maize have advantages such as adaptability in every type of land, low seed prices and can be used for generations [2].
The local production of Siarang Dairi corn ranges from 1.25 tons / ha. Local corn yields that still use previous harvested seeds indicate low seed quality. The low production of local maize caused by unavailability of quality seed when needed and marginal development of the corn [3]. In the 2000s, the production of superior maize varieties could reach 10-12 tons / ha and hybrid maize reached 7 - 8 tons / ha compared to local corn production ranging from 2.5 to 4 tons / ha [4]. Use of local varieties in particular has a tendency for farmers to grow more high-yielding corn varieties, thereby erode the availability of locally useful genes.

Local plants have an important role for genetic resources and can create new varieties. So it needs to be preserved and utilized as well as possible by corn plant breeders for the assembling of superior varieties. IPGRI defines genetic resources as plant genetic material that has value as a source for present and future generations [5].

AIAT of North Sumatra has been doing activities of local plant characterization in the last ± 5 years. This characterization program is an activity supported by both government and local government to maintain and preserve local adaptive genes that have certain advantages. The main objectives of breeding maize are to increase the potential of genetic outcomes, early age, improve pest and disease resistance, improve tolerance to abiotic stress, and nutritional quality analysis [6]. One of the preferred properties of maize varieties is aged to avoid drought at the end of the growth period [7].

Characterization is one of the important stages in the formation of superior varieties that aim to know the important characters of economic value and as a characteristic of the relevant varieties [8]. The purpose of this study was to identify the characters of the local Siarang Dairi maize, Dairi District, North Sumatra whose genes can be used for the assembling of new improved varieties.

2. Methodology

The material used was local corn Siarang Dairi with 5 sample plants. The tools used are meter, ruler, sample plastics, instrument scales, and stationery.

The research used qualitative method with descriptive analysis, including exploration, collection, and characterization. Exploration was done by obtaining the Siarang Dairi local corn and observed the morphological characteristics of the plant. Characterization was conducted by referring to Food Crop Characterization Guidelines especially corn morphology [9].

Siarang Dairi corn samples were taken from Sidikalang Subdistrict plants that had been harvested. Planting was done back in the Garden Collection of AIAT North Sumatra with sandy loam. The data collected included the quantitative and qualitative characteristics of agronomic and plant morphological characteristics. Agronomic characters observed were: plant height. While morphological characters observed included leaf, totally of leaves on top of cob, totally of leaves / plant stem, leaf length, leaf width, leaf orientation after flowering, leaf tip shape, angle between leaf and stem, direction of leaf and stem strands, ligula condition, root volume, stem, panicle length, length of footstalk, branch range of panicle, totally of primary branches on panicle, totally of secondary branches on panicle, totally of tertiary branches on panicle, panicle size after maternity, lateral branch direction, and the angle between the main axis and lateral branch is below from 1/3 panicle, stem colour, percentage of root falling plant, percentage of stuck plant, leaf midrib, panicle type, cob covering length of corncob, length of cob stalk, cob diameter, diameter of corncob, rachis diameter, corncob/rachis index, cornhusk/seed index, rachis/seed index, seed closing index, totally of branches, totally of seeds/row, color of corncob colour, the uppermost form of cob, and the plant grains include grain length, grain width, grain thickness, grain surface shape, pericarp colour, aleuron colour, and endosperm colour. The collected data is tabulated and analyzed descriptively.

3. Result and discussion

3.1. The Agronomic Character and Plant Morphology

The agronomic character of the plant can be seen from plant height in the field taken randomly from 5 plant samples. As well as plant morphological characters characterized on vegetative and generative phases include characterization of leaves, stems, panicles, corncob, and grains of Siarang Dairi corn (table 1).
**Table 1. Vegetative character plant**

| Character                                | Plants |
|------------------------------------------|--------|
| Plant height (cm)                        | 1      | 2      | 3      | 4      | 5      |
| Leaf                                     | Wide   | Wide   | Wide   | Wide   | Wide   |
| Totally of leaves on the top (leaves)    | 6      | 6      | 6      | 6      | 9      |
| Totally of leaves/plant                  | 20     | 26     | 18     | 25     | 28     |
| Leaf length (cm)                         | 88     | 96     | 67     | 83     | 105    |
| Leaf width (cm)                          | 6.5    | 8      | 8      | 7.5    | 6      |
| Leaf orientation after flowering         | straight | straight | straight | straight | straight |
| Leaf tip shape                           | Pointed | Pointed | Pointed | Pointed | Pointed |
| Angle between leaf and stem              | Small $\pm 25^\circ$ | Medium $\pm 50^\circ$ | Medium $\pm 50^\circ$ | Medium $\pm 50^\circ$ | Medium $\pm 50^\circ$ |
| Direction of leaf and stem strands       | straight | slightly curved | arched | strongly curved | arched |
| Ligula condition                        | Exist | No exist | exist | exist | exist |
| Root volume                              | Medium | Medium | Medium | Medium | Medium |
| Panicle length (cm)                      | 21     | 25     | 33     | 42     | 28     |
| Length of footstalk (cm)                 | 18     | 13     | 11     | 9      | 9      |
| Branch range of panicle (cm)             | 5      | 5      | 6      | 5      | 5      |
| Totally of primary branches on panicle   | 5      | 4      | 0      | 6      | 5      |
| (leaves)                                 |        |        |        |        |        |
| Totally of secondary branches on panicle | 2      | 2      | 0      | 2      | 3      |
| (leaves)                                 |        |        |        |        |        |
| Totally of tertiary branches on panicle  | 2      | 2      | 0      | 3      | 1      |
| (leaves)                                 |        |        |        |        |        |
| Panicle size after maturity              | Medium slightly curved | Medium slightly curved | Medium Curved | Small slightly curved | Small Curved |
| Lateral branch direction                 |        |        |        |        |        |
| The angle between the main axis and the  | Medium | Medium | Medium | Medium | Medium |
| lateral branch is below from 1/3 panicle | $\pm 50^\circ$ | $\pm 50^\circ$ | Small $\pm 25^\circ$ | $\pm 50^\circ$ | $\pm 50^\circ$ |
| Stem colour                              | Green | Green | Green | Green | Green |
| Percentage of root falling plant         | 0 %    | 0 %    | 0 %    | 0 %    | 0 %    |
| Percentage of stuck plant                | 3.07 % | 0 %    | 3.07 % | 3.07 % | 3.07 % |
| Leaf midrib                              | Medium | Medium | Medium | Medium | Medium |
| Panicle type                             | Primery- Sekunder | Primery- Sekunder | Primery- Sekunder | Primery- Sekunder | Primery- Sekunder |
3.1.1. Plant height. Observation of plant height were carried out in vegetative phases aged 15 week after planting. The observed morphological results of the local maize of Siarang Dairi maize shown in table 1, indicate that the height of the 5 plant samples ranged from 236 to 277 cm. Uniformity of the height of the plants (figure 1) is possible because of environmental factors one of which is soil fertility. Priyanto et al. [7], stated that crop yield is determined by the interaction between genotype and environmental factors such as soil fertility, weather, soil moisture, and technical culture.

3.1.2. Leaf morphology. Observation of plant leaves was carried out in the generative phases, where the plants had already yielded fruit. Leaf morphology observed included leaf length, leaf width, number of leaves on top of cob, total number of leaves, leaf orientation after flowering, leaf tip shape, angle between leaf blade and stem, leaf and stem direction, and leaf and feather tongue leaf midrib. The results of the observed morphological characterization of local maize of Siarang Dairi in table 1, show that the plants have leaf lengths ranging from 67 - 105 cm with observation data on leaf width, leaf orientation after flowering, leaf tip shape, angle between leaf and stem, and stem, the presence of ligula condition, and the leaf midrib were almost homogen.

3.1.3. Panicle. Observation of a panicle was conducted in generative phases where the panicle was perfectly formed. The results of the observed morphological characterization of the local Siarang Dairi corn in table 1, show that the plant has a long panicle ranging from 21 - 42 cm with a stalk length ranging from 9 - 18 cm. The panicle type, the spacing of the panicle, the totally of primary, secondary, and tertiary branches on the panicle, the size of the panicle after maturity, the lateral branch direction, and the angle between the main axis and the lateral branch below of 1/3 panicles show almost homogen.

3.1.4. Stem. Observation of stem morphology observed included the colour of the stem and the percentage of stuck plant. Table 1 shows that the overall stem colour was green, with the percentage of stuck plants was 3.07%. Based on the agronomic character values of this plant, there is a tendency of the plant to fall in the occurrence of strong winds.

3.1.5. Root. Observation of root morphology observed included root volume and percentage of root fall plant. The results of characterization of observed local root morphology of Siarang Dairi maize in table 1 show that root volume hds medium quantity, with root falling percentage of 0%. This shows the ability or compactness of the roots to withstand plants from extreme weather factors.

3.1.6. Corncob Morphology. The appearance morphology representing Siarang Dairi corncob is presented in the figure 2, 3 and 4.
Table 2. Character Of Morphology Corncob

| Character                  | 1   | 2   | 3   | 4   | 5   |
|----------------------------|-----|-----|-----|-----|-----|
| Length of cob (cm)         | 19  | 17  | 19  | 16  | 16  |
| Length of cob stalk (cm)   | 1.5 | 8   | 1.5 | 3   | 1   |
| Cob diameter               | 4   | 4   | 4.5 | 4   | 4   |
| Corncob diameter           | 3   | 3   | 3   | 2.5 | 3   |
| Rachis diameter            | 1.5 | 2.5 | 2   | 1.5 | 2   |
| Corncob/rachis index       | 2   | 1.2 | 1.5 | 1.67| 1.5 |
| Cornhusk/seed index        | 0.45| 1.6 | 0.95| 0.5 | 0.8 |
| Rachis/seed index          | 0.525| 0.75| 0.7 | 0.6 | 0.8 |
| Seed closing Index         | 2.475| 2.25| 2.3 | 1.9 |     |
| Totally of branches       | 0   | 0   | 0   | 0   | 0   |
| Totally of seed/row       | 34  | 34  | 30  | 30  | 33  |
| Corncob colour             | White| White| Brown| Brown| White|
| The uppermost form of cob  | Cylindrical| Cylindrical| Cylinder cone| Cylinder cone| Cylindrical cone|
| Angular angle of existence | Medium ± 50° | Medium ± 50° | Medium ± 50° | Medium ± 50° | Medium ± 50° |

Observation of corncob morphology observed included length of cob, length of cob stalk, diameter of cob, corncob diameter, rachis diameter, corncob/rachis index, cornhusk/seed index, rachis/seed index, seed closing index, totally of branches, totally of seeds/row, corncob colour, the uppermost form of cob, the angle of existence of the cob and the results are shown in Table 2. The length of cob ranged from 16 - 19 cm with a nearly homogen diameter of 4 - 4.5 cm. The cob does not have branches with totally of seeds/rows ranging from 30 - 34 pieces. The homogen angular angle of cob existence is ± 50°.

3.1.7. Morphology of grain. The appearance morphology of the Siarang Dairi corn grains is presented in the figure 5 below:
Observation of grain morphology observed include grain length, grain width, grain thickness, grain surface shape, pericarp colour, aleuron colour, and endosperm colour, and the results are shown in table 3. The grain lengths ranging from 6 - 8 mm with varying widths ranging from 5 - 9 mm. The thickness of the grains ranges from 3 - 5 mm. Variations of grain surface shape include flat, round and serrated. Pericarp colors include brown, red and orange with varied endosperm colours that are white, light yellow, orange, and beige. While the aleuron colour has a homogen of silvery.

### 3.1.8. Grain Colour
Siarang Dairi corn was analyzed based on the colour classification contained in 1 corncob. The colour classification is shown in figure 6 (a-f).

#### Table 3. Character Of Morphology Grains

| Character                  | Plant          |
|----------------------------|----------------|
| Grain length (mm)          | 1  | 2  | 3  | 4  | 5  |
| Grain width (mm)           | 7  | 6  | 7  | 8  | 8  |
| Grain thickness (mm)       | 4,5| 3  | 3  | 4  | 5  |
| Grain surface shape        | Jagged        | Flat| Flat| Circular| Flat|
| Pericarp colour            | Brown         | Red | Red| Orange| Red |
| Aleuron colour             | Silvery       | Silvery| Silvery| Silvery| Silvery|
| Endosperm colour           | White         | Slow yellow| Orange| White| Krem |

**Figure 6.** The colour classification of the local Siarang Dairi maize grain: a. Chocolate Young chromo; b. Old chocolate (orange in the middle); c. Dark brown; d. Dark Brown (in the middle is light brown whitish); e. Blackish and f. Yellow

### 3.2. Protein and Lipid analysis of Local Siarang Dairi Grain
The protein and lipid content of the local Siarang Dairi corn are shown in table 4. The results show that the content of these compound in the grain of the plant vary between colour categorization of the grain. The highest protein content showed by chocolate young chromo grain (8.64%) while dark brown coloured grain with light brown whitish in the middle had the highest lipid content.
Table 4. Protein and lipid content of the local Siarang Dairi maize grain

| Colour                                             | Protein (%) w/w | Lipid level (%) w/w |
|----------------------------------------------------|-----------------|---------------------|
| Chocolate young chromo                              | 8.64            | 4.04                |
| Old chocolate (orange in the middle)               | 8.30            | 3.48                |
| Dark brown                                         | 8.28            | 3.76                |
| Dark Brown (in the middle is light brown whitish)  | 8.17            | 4.10                |
| Blackish                                           | 8.32            | 3.56                |
| Yellow                                             | 8.58            | 3.79                |

5. Conclusion

- Characterization of morphology of local corn Siarang Dairi include plant height ranging from 236 - 277 cm and a leaf length ranging from 67 - 105 cm. Leaf width, leaf orientation after flowering, leaf tip shape, angle between leaf blade and stem, leaf and stem leaf direction, leaf tongue, and almost uniform leaf midrib. The length of panicle ranges from 21 - 42 cm with a long stalk ranging from 9 - 18 cm.
- The length of the cob ranged from 16 - 19 cm with almost homogenous diameter of 4 - 4.5 cm. Corncob does not have branches with the total of seeds/rows ranging from 30 - 34 pieces. The homogenous angular angle of corncob existence is ± 50°.
- The length of grains ranging from 6 - 8 mm with a wide variation ranging from 5 - 9 mm. The thickness of the grains ranges from 3 - 5 mm. Variations of grain surface shape include flat, round and serrated. Pericarp colours include brown, red and orange with varied endosperm colours that are white, light yellow, orange, and beige. While the aleuron colour has a uniformity of silvery.

Reference

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