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(RESEARCH ARTICLE)

Availability of millable cane sugarcane seed (*Saccharum officinarum* L.) necessity through the improvement of planting material

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Abstract

Availability of quality seeds is one of the efforts to increase the productivity of sugarcane and crystal per hectare, because seeds are one of the essential production factors and determine the overall sugarcane production. The research conducted from March to November 2021, in the flat field of sugar factory. Wringin Anom Situbondo covering area of 0.337 hectare. The varieties of seeds planted are Bululawang originated from millable cane using the two buds method. In this research, measured the seed production of millable cane in quintals per hectare provide from spread seed. Production estimates were calculated using yield components, which are the number of saplings per hectare, effective slit length (sugarcane ridge), number of stems per meter of line, harvestable stem length and stem weight per meter. Planting at the spread seed level uses the mule method to produce commercial sugarcane millable cane. The estimation of millable cane production on sugar factories filed. Wringin Anom using mule planting material resulted in a production of 218.69 quintals per hectare. The seed breeding rate based on planted area compared to spread seed land area is 8.1. Fulfillment of millable cane seeds in Sugar factory Wringin Anom Work Area requires a nursery for spread seed covering an area of 28.52 hectare. As the Working Area of sugar factory. Panji requires a seed garden for spread seed covering an area of 6.6 hectare with the assumption that the first planting area is 25% of the sugarcane planting area in each working area. Sugarcane seeding is still needed to ensure the fulfillment of seed needs to secure the needs seeds in planned production field.

Keywords: Nursery; Multiplication; Production Taxation; *Saccharum officinarum*

1. Introduction

Provision of quality seeds is one of the efforts to increase the productivity of sugarcane and crystal per hectare, because seeds are one of the main production factors and determine sugarcane production. So far, farmers carry out unloading of ratoons more than 5 times and the sugarcane seeds used do not have a clear origin so that they are of low quality because they have decreased genetic quality. The diffusion of superior sugarcane research results to farmers is also still not optimal. This causes the production of quintals per hectare of sugarcane is very low and heterogeneous. The technical culture of sugarcane cultivation can be improved by rehabilitating plants by replacing high-yielding seeds or removing ratoons, the seeds available are homogeneous, early, middle or late ripe. One of the strategies for propagation of sugarcane seeds is to expand spread seed land in each sugar factory working area as a provider of commercially superior sugarcane seeds for farmers with high quintal production per hectare.

The sugarcane nursery level starts from the foundation seed through tissue culture, while the foundation seed, stock seed to extension seed is propagated by mules. This tiered seed propagation program can also be used for systematic and structured planning regarding the supply of sugarcane seed needs with the bud chip and ratoon unloading methods. For a maximum period of 3 years, all sugarcane cultivation systems must be integrated with the sugar factory management so that transparent and accountable management is formed. Seed requirements are based on the planted

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area in the sugar factory work area. Wringin Anom and the distribution of seed breeders in the Sugar Factory area in Situbondo Regency will be answered from this research. The results of the study can be used for recommendations for the projection of the area of planting land for seed captivity to meet the needs of the millable cane in the sugar factory Working Area in Situbondo Regency.

2. Material and methods

The research was carried out to increase the productivity of sugarcane in the sugar factory working area in Situbondo Regency, by means of captive breeding of sugar cane seeds through the expansion of spread seed land. The sugarcane seeds planted were from the Bululawang (BL) superior sugarcane variety, which was the spread seed -level seed from the second year of research. In the first and second studies, sugarcane seeding experiments were carried out using the single bud planting method at the stock seed level (first year research) and spread seed level (second year).

2.1. Planting Preparation

Preparation for planting begins with making mounds and juringan, three weeks before planting. The grid is made of 8 m long with a PKP of 1 m and the garden tare for paddy fields is 6 percent so that the total grid is 1175 per hectare. The unfortunate and lucky sewers were made before the juringan was made. Lucky gutters also function as roving sewers. Juringan rested for three weeks before starting to plant. Then proceed with making mattresses and sugarcane seeds ready to be planted. Two-eyed mule seeds were planted using 50 x 50 cm spacing in rows. Fertilization was carried out at a dose of ZA 6 quintals per hectare, SP 36 6 quintals per hectare and KCl 1 quintals per hectare. The first hoarding at the age of 30 DAP and the second at the age of 60 day of planting. Thiodan 35FC with a concentration of 2 mL L^{-1} of water was used to control pest development.

2.2. Production Tax

Production estimates were calculated using yield components, namely the number of saplings per hectare, the effective length of the line (sugar cane), the number of stems per meter of line, harvestable stem length and stem weight per meter [1].

$$P = Jbtpk \times Jkha \times Tbt \times Bbt$$

Information:

P = Sugarcane yield per hectare
Jbtpk = Number of sugarcane stalks per meter of water (juringan)
Jkha = Amount of water (juringan) per hectare
Tbt = Height of the stem, measured to the point of fracture
Bbt = Weight of bar per meter

Meanwhile, multiplication or captive breeding of seed yields is measured by the formula: Captive = Planted Area: Seed area.

3. Results and discussion

3.1. Superior Sugarcane Seed Development

Wringin Anom Sugar Factory is located in Panarukan District with a sugar cane growing area of 924.0 hectares. The land area is able to provide production of 11,088.00 tons. Wringin Anom Village is one of 6 villages in Panarukan District. About 80% of sugar cane milled at the Wringin Anom sugar factory comes from sugar cane grown in Wringin Village, while the remaining 20% is sugar cane that comes from villages near Wringin such as Peleyan and Duwet.

The delay in the supply of sugarcane raw materials causes sugar production in sugar factory. Wringin Anom, Situbondo Regency tends to fluctuate. The delay in the supply of raw materials is due to low productivity which is triggered by the low quality of seeds used by farmers. Most of the seeds planted do not come from captive farmers who specialize in cultivating high-yielding sugarcane seeds.

3.2. Millable Cane (MC) Production Taxation

At the time before harvest, the measurement of production per hectare can be done through the approach of estimating shoot production per hectare with exponential regression analysis using the variable number of stems per meter. Numerically, the exponential combination provides a very simple calculation, so it is easy to apply to various fields [2].

Figure 1 Production Taxation in sugar factory. Wringin Anom

Production Taxation is carried out to determine the number of sugarcane seeds (quintals) that can be produced from a garden area (hectare) (figure 1). The estimated production per hectare gives the results as presented in Table 1.

Table 1 Millable Cane level production estimation

No	Number of sugarcane stalks per meter of water	Height of the stem	Avarage Weight of bar	Number of juring	Production Taxation
1	6	1.56	1.67	1175	183.30
2	4	1.96	1.67	1175	153.53
3	8	1.76	1.67	1175	275.73
4	4	1.53	1.67	1175	119.85
5	4	1.50	1.67	1175	117.50
6	8	1.56	1.67	1175	244.40
7	10	1.50	1.67	1175	293.75
8	8	1.00	1.67	1175	156.67
9	10	1.57	1.67	1175	307.46
10	10	1.57	1.67	1175	307.46
Average	7.20	1.55	1.67	1175	218.69

The propagation of sugarcane seeds carried out by most sugarcane farmers still uses the mule method, namely the main cane stem (elder) is cut with a knife, consisting of 2 or 3 eyes. This mule propagation method in 1 hectare of the mother garden (elder) is only able to produce 7 to 10 hectares of sugar cane seeds. Thus, this method of mule propagation requires a large area of land to meet the needs of millable cane.

In the third year of research, planting extension seed to produce commercial sugarcane millable cane uses the mule method. The need for planting material in the form of stem cuttings with 2-3 buds is about 6-8 tons per hectare of sugarcane seedlings [3] or the equivalent of 32 thousand two-eye mules [4]. The seed requirement is equivalent to 8-10% of the total area of production plant land [5]. Therefore, it is necessary to find a form of seed that is faster and cheaper in its supply.

Estimated spread seed production on sugar factory's land. Wringin Anom with mule planting material produced a production of 218.69 quintals per hectare. Assuming the need for planting material is 8 tons per hectare, the planted area for spread seed is 2.73 hectares. The captive calculation pattern that has been used by sugar factory. Wringin Anom is planted area divided by spread seed land area so that with an experimental garden area of 0.337 hectares, the spread seed seed breeding to millable cane level is 8.1. This is higher than the results achieved by sugar factory's experimental garden. Wringin Anom has been using spread seed seeds from their own captivity.

The millable cane produced in this third study came from spread seed from the second year of research which was planted using the singgle bud planting method. The production of spread seed with the single bud planting method is 955.64 quintals per hectare with a multiplication rate of 9. Meanwhile, the production of millable cane using the mule method is only 218.69 quintals per hectare and the multiplication rate is 8.1. The results of the study stated that the treatment from seeds from the flat Nursery showed a plant height that was always higher than sugarcane seeds from milled sugar cane [6]. In the third year of research, sugarcane production in quintals per hectare decreased according to the results of the study [6]. Mule breeding method has a lower production potential in producing the number of stems compared to the results of the singgle bud planting method. The results of the study [7] showed that the use of budchip seeds was able to increase the number of stems by 5.30-5.98% of mule seeds. In addition, the use of bud chips seeds can increase stem weight by 4.25-5.58% of mule seeds.

An increase in the number of sugarcane stalks and stem weight causes an increase in sugarcane productivity [8]. Planting systems that produce high number and weight of stems will be followed by high sugarcane productivity as well.

Figure 2 Observation of Sugarcane at the Age of 4 Months after Planting (MAP)

Captive breeding with the singgle bud planting method is different from the mule system. One bud set planted will produce 8 stems per clump with an average multiplication rate of 80 eyes so that with a correction factor of 10% it will produce 70 buds buds. According to [9] the average number of stems per clump was 9.18 with an average number of eyes per stem 9.92 so that the multiplication was 91.07 with the treatment of N fertilizer dose and transplanting age. The tiller propagation process is very important as the basis for the formation of plant populations and the number of stems harvested [10].

[11] also proved that two types of bud chips and bud set significantly increased leaf count, tiller number, crown fresh weight, and shoot dry weight at 12 weeks after planting compared to mules. However, bud set seeds that are longer than bud chips produce higher growth than bud chip seeds. The larger the size of the seed, the more food reserves, so that the growth of the seedlings is more secure [12]. This is related to the availability of food reserves in sugarcane stalks. The larger the size of the seed, the more food reserves are available.

The stem is the main part so that the growth of sugarcane stems greatly determines the amount of sugarcane yield. Sapling is an important link because each sapling will produce a stem so that the number of stems determines the number of buds of sugarcane seeds. In Flat Seed Gardens, optimizing the budding phase results in the maximum number of buds. The number of stems and buds per stem is the main contribution in the production of shoots in the Flat Seed Gardens. In the Flat Seed Gardens and Milled Sugarcane Gardens, the presence of sogolans is not desired. Sogolan can reduce the number of productive seed buds harvested. Sogolan stems emerging from primary and secondary shoots have large stems, short plants with broad and thick leaves, [13]. Observations on the number of new internodes can be made when the plant is 4 month after planting old, because the sugar cane stems are only really visible when the sugar cane plant is 4 month after planting (figure 2).

3.3. Spread seed level breeder farmers

Captive breeding is the ratio of the area of spread seed to the area of millable cane that can be planted. In Java, every 1 hectare of nursery can meet the needs of 8 hectares of milled sugar cane, while outside Java it is smaller, namely 1 hectare of seedling plantations that can only meet the needs of 6 hectares of milled sugar cane. According to the opinion of [5], only 40% of seed needs can be met by sugarcane breeders, the rest using local sugarcane with low productivity.

The nursery level is the seedling breeding stage that functions to control the quality of the seed class in the propagation process, until the sugarcane seeds are ready to be used as planting material for millable cane. With the implementation of a good nursery level, the seeds used as planting material for millable cane can be trusted for their origin, purity of the variety and the level of health of the seeds from pests and diseases. Farmers in Situbondo still use seeds purchased from other farmers who sell their sugarcane at the age of 6-7 months for economic reasons (needs money before harvest at the age of 12 month after planting). Sugarcane that is used as seed with unclear varietal origins and purity will certainly result in low production. In this research, it is hoped that there will be more sugarcane farmers engaged in nurseries by taking into account the requirements of the nursery.

The experimental land is dry land and spread seed planting is carried out in March-May 2021. spread seed in paddy fields requires 16.7% of the area of the cane plant and milled sugarcane embroidery, while on dry land it requires up to 25% of the area of the plant cane and milled sugarcane embroidery [14]. As the purpose of holding spread seed is to provide millable cane planting material, so to meet the needs of millable cane seeds, it is necessary to regulate the composition between spread seed and millable cane with a ratio of 1: 5, meaning that from every 1 hectare spread seed is expected to produce sugarcane seeds for 5 hectares of millable cane. This means that the minimum spread seed sugarcane seedling rate is 5. The results of the study provide a higher breeding rate because at the spread seed level using the single bud planting method. Bud set seeds produced more stems than mule seeds while the number of tillers was positively correlated with the number of stems produced [15]; [16]. By comparing the planted area (2.73 hectares) with the spread seed land area (0.337 hectares), the breeding of seedlings can be up to 8.1. This result is not much different from the results of research [17] which states that sugarcane seeds from 1 hectare of land can be used for 10 hectares of planting.

According to research conducted by [18] there are several things that must be considered starting from the beginning of cultivating the land, fertilizing, maintaining, selecting varieties, to harvesting seeds, and spreading them. The results showed that in general, sugarcane farmers used sugarcane seeds which were easily obtained when needed at an affordable price. Sugarcane seed product is in the form of sugarcane seeds which are commonly planted and deemed suitable for local conditions. Therefore, the superior sugarcane seed product from this research will be able to be absorbed by the market because it is very much needed by farmers.

Table 2 Land Area of Extension Seed

Research Area	Land Area (ha)	Planting Area of Ratoon (ha)	Seed Requirement Two Bud (ton)	Land Area of Extension Seed (ha)
Sugar factory. Wringin Anom	924	231.00	18.480	28.52
Sugar factory. Pandji	214	53.50	4.280	6.60

As presented in Table 2 the planted area for the sugar factory Working Area. Wringin Anom 924 hectares. If 30% of the area is carried out by dismantling ratoons and planting new seeds, then around 3.4 billion seedlings are needed [19]. The average planting area of ratoon yields is 25% of the total planted area, including embroidery = 5%). If the Plant Cane area is 25% of the total planted area, then the millable cane land area is 231 hectares. With a seed requirement of

80 quintals per hectare, the seed required is 10,395 quintals. The breeding rate of the research results is 8.1, then the area of spread seed needed in the sugar factory. Wringin Anom is 28.52 hectares. For sugar factory Work Area. Panji with a planting area of 214 hectares, millable cane sugar factory land needs are 53.5 hectares with a seed requirement of 3,424 quintals. Assuming a captive rate of 8.1, the need for spread seed land in the Sugar factory Working Area. The pennant is 6.6 hectares.

The high demand for commercial seeds for farmers will absorb sugarcane seed production wide open. This causes the sugarcane seed breeding agribusiness to be very profitable. Guidance for potential sugarcane seed breeders in all potential areas for sugarcane cultivation is carried out to provide superior sugarcane seeds at the flat spread seed level. Sugarcane seeding is still needed to ensure the fulfillment of seed needs in accordance with the needs of the planned production garden. The seeds produced must be pure, healthy and of good quality. Planning for sugarcane seed needs is based on the area and composition of varieties to be planted in millable cane in the next 2 years.

This sugarcane seed breeding business is quite profitable, so coaching for sugar cane seed breeders is very necessary. Utilization of dry land such as in Situbondo for the implementation of the spread seed expansion program using environmentally adaptive superior sugarcane seeds. This effort needs to be developed because there are still many sugar factories that do not have flat spread seed facilities to produce superior sugarcane seeds to meet the needs of seeds in their working areas.

4. Conclusion

The results showed that the rate of captive sugarcane seedlings was quite high, namely 8.1 exceed the captive standard in the sugar factory work area. Wringin Anom and sugar factory. The pennant is 6-7. Spread seed land area in sugar factory. Wringin Anom needed to meet the needs of millable cane land seeds in the 924-hectare plant cane program is 28.52 hectares. Meanwhile, for the sugar factory work area. Panji, the spread seed land area needed to meet the needs of millable cane land seedlings in the 214 hectare plant cane program covering an area of 6.6 hectares. With the high demand for superior seeds at the farmer level, the prospects for the sugarcane seed breeding business are quite good.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declared that the present study was performed in absence of any conflict of interest.

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