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AGRONOMIC TRIALS OF TEBU TERUBUK (*Saccharum edule* L.) T SUPPORT FOOD DIVERSIFICATION AND FOOD SECURITY

IN PAPUA, INDONESIA

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Abstract

The sustainability of national food security needs to be developed and strengthened improve the domestic food supply. The primary objective of the diversification of f production is to attain greater self-sufficiency and food security. With the current situati which the global food price increased at the international and national markets, emphasize food promotion and usage should be based on traditional food crops.This can be increased exploring the local food plants and improving an agricultural production. Papua is conside as a place of mega diversity of plant species. It is the primary center of *Saccharum* divers Among the *Saccharum* species that grows widely in Papua is *Saccharum edule* that have been exploited and scientifically studied for their potential use. The inflorescence of *S. ed* is a delicate part for consumption. With the growing concern of food production short food security problem, limited supply, and growing demand of *S. edule* in the local mar exploration and identification of this plant was conducted at the selected areas of Papua Papua Barat provinces, covering the lowland and highland areas, from June to Septem 2009. It showed the variability in morphological traits of 77 accessions. To attain maximum growth and yield of *S. edule*, the following agronomic researches of *S. edule* w soybean intercropping and cutting types were carried out with the selected *S. edule* pl distances and cutting types from June to December 2010. *S. edule* of 200 cm x 200 produced the highest biomass, flower number and weight. Tip cuttings produced the b growth and inflorescence characters. Cutting trial was also carried out to observe the b cutting that produce better growth and inflorescence yield. Based-cutting produced grea flower yield and number.

Keywords : *Saccharum edule*, exploration, identification, diversity, intercropping, cuttings

1. INTRODUCTON

Papua is a home to diversity of plant species that have not been exploited for their potential use. Among the food plant species that have not been scientifically studied is *Saccharum edule* (Quartermain, 2006). *S. edule* is among the *Saccharum* species, which belongs to the same family of sugarcane (*Saccharum officinarum*). The plant grows widely in the land of Papua, and hence this area is considered as the center of *Saccharum* diversity (Daniels and Roach, 1987). The genus *Saccharum* consists of six species *S. officinarum* L., *S. sinense* Roxb., *S. barberi* Jesw., *S. edule* Hassk., *S. robustum* Brandes and Jesw. *ex* Grassl and *S. spontaneum* L., of which the former four species are cultivated and the latter two species are wild (D'Hont *et al.*, 1998).

The local Papuan name for *Saccharum edule* is *sayur lilin or tebu terubuk*. *S. edule* has an aborted inflorescence that enclosed inside the leaf sheaths (Glyn, 2004). This inflorescence serve as an edible part for consumption and can be prepared in many ways (Mudaliar, 2007). In the highland areas of Papua, the leaves were used for thatching the roof of traditional house, while stem is used to make the traditional music instrument.

Saccharum edule plays a significant role as a source of vegetable; however the production is generally in the hands of small subsistent farmers with lack of cultivation techniques. With future concern of increasing population and decreasing cultivated land, and also concerning the genetic erosion, evaluation of *S. edule* is needed. With the global food price increased at the international market, emphasize on food promotion and consumption should be emphasis on traditional food crops. It is believed that *S. edule* grow widely in Papua and its diversity needs to be preserved in order to support food security and the sustainability of biodiversity.

The agronomic aspects of *S. edule* need to be studied through intercropping and cutting trials. Intercropping is a traditional farming practiced by Papuan from generation to generation. *S. edule* is commonly planted with root crops and various vegetables. However, the productivity is unstable and low due to several factors including inappropriate cultural practices. Farmers use inappropriate population density or irregular plant distances. As a consequence the plants usually suffer from poor growth and development and finally low yield. *S. edule* is multiplied with stem cutting, however there is no study yet related to the use of cutting type of *S. edule* which produce good yield.

Research was aimed to observe the influence of plant distance of *S. edule* to growth and yield of *S. edule* in *S. edule* - soybean intercropping system. The research was also aimed to observe the influence of stem cutting types on selected *S. edule* to growth and yield of *S. edule*.

2. RESEARCH METHODS

The experiments were carried out in the experimental field of the Agriculture Faculty Pa State University Manokwari, which lies on the 110 m above sea level, in 2011. *S. edule* w intercropped with soybean with different *S. edule* plant distances (P1 = 100 cm x 100 cm; P2 = 150 x 150 cm; P3 = 200 cm x 200 cm). The experimental design was Randomized Complete Block De with 4 replications. Data was collected on plant height, biomass fresh weight, sucker number per pl the number and weight of *S. edule* inflorescence. Data of seed weight per plant and per plot soybean was also collected. The data were analyzed using analysis of variance. The Duncan's Mul Range Test (DMRT) was used as the mean comparison among treatment means.

In the following trial, the growth of 3 stem cutting types (tip-cutting, middle-cu and based-cuttings) were compared using 5 accessions of *S. edule*, namely Saukori Me Wamena, Mandopi Hijau, Fak-fak, and Serui. A factorial experiment was used wi Randomized Complete Block Design and 4 replications. Observations were made on vegetative (shoot initiation age, shoot length, shoot number, plant height and pl number/sucker) and generative growth components (flower number, flower length, flo fresh weight, flower dry weight). Analysis of variance was conducted to test the signific of each treatment effect and their interactions. The means of treatment combinations w compared by the Tukey Test to determine whether the effects of the treatments on pl growth parameters were significant.

3. RESULTS AND DISCUSSION

3.1 Intercropping *S.edule* with soybean

Significant reduction in plant height was observed when plant spacing was red (Table 1). P3 produced taller plants, followed by P2 and P1, respectively. P3 also signific produced greater biomass weight and number of plant suckers than P2 and P1.

Table 1. Mean of plant height, fresh biomass and sucker number of *S. edule (L.)* as affected by 3 plant distances in a *S. edule* and soybean intercropping system

Treatment	Plant height (cm)	Fresh biomass weight (gr)	Sucker no/plant
P1 (100 cm x 100 cm)	89,8 c	82,3 c	3,8bc
P2 (150 cm x 150 cm)	117,7ab	111,3b	4,5ab
P3 (200 cm x 200 cm)	130,1a	147,0a	5,0a
Monoculture	90,2	82,4	3,8

Values within a column followed by the same letter symbol are not significantly different ($p < 0.05$).

With increasing number of plants per unit area, interplant competition for soil and other resources and light increased. As a result, under shorter plant distance (higher population density) mutual shading increased, reducing biomass weight and restricted the growth of *S. edule* suckers.

Plant distance did not influence the number of flowers per plant but it affected the weight of inflorescence (Table 4). Increased plant density produced greater weight of inflorescence per plant. Plant density plays an important role in intercropping, because it is related to the light penetration into the canopy. Limited penetration of sunlight into the canopy might be one of the reasons for lower weight of inflorescence. This might due to the higher the population density, the greater the effect of shading in intercrop system, as observed by Hang *et al* (1984).

Table 2. Mean of flowering age and number of flower/plant of *S. edule* (L.) as affected by 3 plant distances in a *S. edule* and soybean intercropping system

Treatment	Flowering age (HST)	Number of flower/plant
P1 (100 cm x 100 cm)	157,8b	3,3a

P2 (150 cm x 150 cm)	153,5b	3,3a
P3 (200 cm x 200 cm)	151,8a	3,8a
Monoculture	157.9	3,4

Values within a column followed by the same letter are not significantly different ($p < 0.05$).

Different *S edule* plant spacing did not significantly influence seed weight of soybean p plant (Table 2); however there was a significant reduction in seed weight per plot area with increasi plant density of *S. edule*. With increased *S. edule* plant distance, population density of soybe increased, as there was interplant competition for light, water and nutrients resulted to decreased se weight of soybean in close distance.

3.2 Stem cutting trials on 5 accessions of *S. edule*

The experiment was carried out to observe the influence of stem cutting types on the grow and yield components of *S. edule*. It shows that the accessions of Local Fak-fak and Manokwari (R Saukori and Green Mandopi) produced the fastest shoot growth. The both accessions also produc more shoot number compared to the other accessions (Wamena and Serui) (Table 3.). This sugge that the accession of Local Fak-fak was more responsive to the environmental conditions i Manokwari where the trial was carried out compared to the accession of Wamena and Serui. Wame is the highland site, while Fak-fak and Manokwari is the lowland site. As due to the ecological a geographical isolation (ecogeographic), a number of different characters and the response betwe those 2 locations appeared. Eco-geographic isolation is one of the external factors such as clima water, soil, and topography that act as a catalyst for the emergence of various barriers, thus allowi each population in a particular ecosystem to have typical characteristics of the region (Mawike 2005).

Table 3. Mean of shoot initiation age, shoot length, shoot number, plant height and plant number/sucker of 5 accessions of *S. edule* (L.) as influenced by 3 types of stem cuttings

Treatment	Shoot Initiation Age (HST)	Shoot Length (cm)	Shoot Number	Plant Height (cm)	Plant Number/ Sucker
Cutting					
- Tip	4.74	9.73	5.40a	83.21	18
- Middle	4.12	9.10	4.15b	70.89	18
- Based	5.25	9.80	4.35b	86.36	18
Accession					
- Saukori Red	4.66	9.32	5.92a	86.36	20ab
- Mandopi Green	4.9	11.23	4.50b	85.67	14c
- Wamena	5.18	9.75	3.92b	77.63	17bc
- Local Fakfak	4.52	9.17	4.92ab	75.33	21a
- Serui	4.25	8.25	3.92b	75.78	17bc

Tip cutting produced more shoot number than other stem cutting types. This is due to the ability of shoot cuttings to grow faster than the middle and based-cuttings. Leaf buds serves as photosynthetic site and the photosynthetic products are used to promote root growth. According to Harjadi (1993) leaf is the site of auxin synthesis, and it also produces carbohydrates that stimulate the formation of root cuttings. The present of growth substance and photosynthate may accelerate the stimulation of stem sections of *S. edule* to form new shoots.

When the growth developed however, *S. edule* grown from the based-cuttings produced the fastest age of shoot initiation, the highest shoot length and plant height, on the other hand, plants grown from center-cuttings had the shortest plant height. This is because at the time of planting roots of the based-cuttings were still attached, and therefore further growth process accelerated the formation of leaf and stem sections.

The growth of plants from tip-cuttings was more directed to the formation of new roots and shoots. The tip-cuttings contain more carbohydrates than the middle and based stem cuttings. According Rismunandar (1990) the availability of carbohydrates and protein in the plant will affect the process of plant growth. In the process of root formation, cuttings require energy that stored in th plant tissue in the form of carbohydrate and protein. Cuttings with high carbohydrate content w easily rooted than cuttings with low carbohydrate content, while cuttings with higher protein cont will be more easily stimulated leaves growth. At the based-cutting, as due to relatively older st tissue, the carbohydrates decreased but the protein content (especially nitrogen) remain high. Prot contains nitrogen in order to stimulate the growth of leaves, especially in the formation of green m leaves that are useful in the process of photosynthesis (Lingga, 1986).

Table 4. Mean of the flower number, length, fresh and dried-weight of 5 accessions of *S. ed* (L.) as influenced by 3 types of stem cuttings

Treatment	Flower Number	Flower Length (cm)	Flowers fresh weight (g)	Flowers dried weight (g)
Cutting				
- Tip	6.48	37.12	62.76	5.12
- Middle	6.72	35.60	59.36	5.06
- Based	8.04	38.70	64.28	5.14
Accession				
- Saukori Red	7.47	38.53	61.40	5.03
- MandopiGreen	6.57	36.07	60.17	5.23
- Wamena	7.27	33.70	60.40	5.10
- Local Fakfak	7.90	41.10	64.60	5.63
- Serui	6.20	36.30	64.10	4.97

4. CONCLUSIONS

S. edule with the density of 200 cm x 200 cm produced highest plant weight, biomass weight, number of sucker, flower number and weight under intercropping sy with soybean. Soybean seed weight per plant and per plot area increased with decre population number or reducing plant density.

Based-cuttings showed the best vegetative and generative growth compared to the tip and middle-cuttings. The accessions of Local Fakfak and Red Saukori (Manokwari) produced the best vegetative growth and accession Fakfak also yielded the highest generative components. Tip-cuttings of accession Local Fakfak and Red Saukori produced the best vegetative growth, while based-cutting of the accession Local Fakfak produced the best generative characters.

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REFERENCES

Daniels, J. and Roach, B.T. 1987. Taxonomy and evolution. *In*: 'Sugarcane Improvement Through Breeding'. Ed. DJ Heinz. Chapter 2. Elsevier, Amstredam, Netherland. 11:7-84.

D'Hont, A., Grivet, L., Feldmann, P., Rao, S., Berding, N., Glaszmann, J.C. 1998. Determination of basic chromosome numbers in the genus Saccharum by physical mapping of ribosomal RNA genes. *Genome*. 41:221-225.

Glyn. 2004. Sugarcane. 2nd ed. Blackwell Publishing Company. Oxford. UK. Pp. 7.

Hang, N., McLo,rd D.E., , K.J., and Duncan, W.G. 1984. Shade effects on growth, partitioning, and yield components of plants. Crop Science. 24:109-115.

Harjadi, S.S. 1993. Pengantar Agronomy. Gramedia. Jakarta.

Lingga, P. 1986. Petunjuk penggunaan pupuk. Penebar Swadaya. Jakarta.

Mawikere, N.L. 2005. Plasma nutfah kelapa Papua dan hubungan kekerabatannya dengan populasi kelapa Indonesia lainnya dan Papua New Guinea berdasarkan penanda RAPD [Disertasi]. Bogor: Program Pascasarjana, Institut Pertanian Bogor. (In Indonesian Language).

Mudaliar T. 2007. Duruka (*Saccharum edule* L.) Growing in Fiji. Technical Bulletin. Ministry of Primary Industries Fiji. No 4. June 2007.

Rismunandar. 1990. Hormon tanaman dan ternak. Penebar Swadaya. Jakarta.

Quartermain, A.R. 2006. Underutilized species policies and strategies. A Report. National Agricultural Research Institute (NARI) Lae, Papua New Guinea. Analysis of national and institutional policies in Papua New Guinea that directly or indirectly affect the use of currently underutilized species of crops for food and agriculture.