Tabela Systems for Sustainabilty Agriculture in Northern of Sumatera

Ameilia Zuliyanti Siregar[1*], Rahmat Widia Sembiring[2], Lusiana Andriani Lubis[3] and Fachri Yunanda[4]

[1]*Departement Agrotechnology, Faculty of Agriculture, Universitas Sumatera Utara*
[2]*Department Management Information, Polytechnic Negeri Medan*
[3]*Department Communication, Political and Social Sciences, Universitas Sumatera Utara*
[4]*English Education Department, Faculty of Teaching and Education, Universitas of Prima Indonesia*

Keywords: Tabela, Sustainability, Agriculture, Atabela, Sumatera.

Abstract: In irrigated wetland agro-ecosystem, the sowing of rice seeds is carried out directly on the condition of the ground not waterlogged. Direct seed planting system (called 'Tabela') is the planting of rice plants without going through the nursery and removal of seedlings. Cultivation of direct rice seed crop categorized into 2 sections, such as: scatter (sonor/brodcast) where the seeds are sown evenly, while the Tabela array with the drum seeder spaced 25 cm between rows. The result shows that technology have the comparative advantage than transplanting method in rice cultivation. Adoption of direct seeded rice influenced significantly by land ownership, cost of planting and maintenance, planting season, researcher or extension worker guidance and location. Based on the result, the Tabela technology is suitable to be developed in the region where there is a shortage of agricultural labor occurs. It reduces labor and cost for planting and maintenance which increase income of the farmers. However, the socialization of direct seeded rice technology is still needed guidance from researcher and extension workers. The characteristics of farmers influence in receiving information from agricultural extension workers, such as through interpersonal communication through agricultural extension visits to individual farmers, group communication through plot demonstrations, and also through mass communication through brochures, posters, leaflets, manuals and electronic media (television, radio, internet).

1 INTRODUCTION

Rice demand will continue to increase along with population growth rate. Based on the realization of paddy production in the last 5 years, it is indicated that the growth rate of rice production is decreasing and production cost per unit of land is increasing. Therefore, the achievement of rice production target in the future will be more difficult. To overcome this problem, the Government is aiming to increase the national rice production by 2015 by 1.5% per year. In this context, various breakthroughs of rice production are needed.

In general, Tabela is defined as one way planting or cultivation of crops by spreading the seeds directly in the cultivation area or planting crops that are not through the nursery so that none exists transfer of seedlings to planting areas (Haryadi, 1985 and Bismar, et al., 1985). Practice of Tabela in rice farming in Indonesia has actually been done before the farmers the existence of tandur jajar system or planting move. But at that time it did not develop because of various constraints (Supriadi and Malian, 1995).

Along with the development of science and technology, Tabela system again made an alternative in rice farming because it is considered more efficient. Some countries in Asia have changed the way rice cultivation from moving plant systems (Tapin) to Tabela system. Factors that have motivated farmers to apply Tabela's technology Asia, among others, due to the onset of environmental changes in farming, ie improved irrigation system, availability of short-lived, high-yielding rice varieties, herbicides effective and inexpensive, and rare and expensive workforce (De Datta and Nantasomsaran, 1991).

In the Philippines and Malaysia, these cultivation techniques change to 27 percent and 99 percent of the total area of rice cultivation and has been ongoing since 1987 Thailand (mainly in the North and

Siregar, A., Sembiring, R., Lubis, L. and Yunanda, F.
Tabela Systems for Sustainabilty Agriculture in Northern of Sumatera.
DOI: 10.5220/0010046005290535
In *Proceedings of the 3rd International Conference of Computer, Environment, Agriculture, Social Science, Health Science, Engineering and Technology (ICEST 2018)*, pages 529-535
ISBN: 978-989-758-496-1

Northeast), the proportion of the Tabela system in business rice farming reached more than 80 percent (Isaranurak, 1995). Similarly with di Japan, where the proportion of Tabela to the entire area of rice farming is experiencing development from about 8 percent in 1973 to 30 percent in 1990 (Osamu, 1995). In South Korea, cultivation of rice by way of transplanting the already moved using tools and cultivation machines have also begun to shift to the application of cultivation spread directly.

Although the production of rice in North Sumatra throughout 2017 reached 5.1 million tons or a surplus of 1.7 million tons of the calculated demand of 3.4 million tons. This number increased compared to the previous year. With this surplus, surely we are over production and then sent to other areas such as Riau province and others who need it, "said Azhar Harahap, head of Food Crops and Horticulture of North Sumatra.To 2018, North Sumatra Provincial Government targets to increase rice production to 5-10 percent compared to 2017.

Given the important functions and roles of the paddy, the Government seeks to realize increased rice production by 2015 through the Integrated Crop Management (GP-PTT) and Other Special Efforts (Upsus) Movement. In relation to this, program implementers in the field need guidance for various rice cultivation technologies that have been developed in Indonesia, especially the technology of Rice Cultivation Seeds Direct (Tabela) which adopt local wisdom in North Sumatra.

1.1 Definition of Planting Seed Direct (Tabela)

Direct seed planting technology (Tabela) Tabela rice has several advantages, such as shortening the period of rice production so as to increase the index of crops and reduce labor costs for planting. Tabela technology can be applied to irrigated wetland agroecosystem, rainfed lowland, and tidal land. In general, Tabela applies the approach model of Integrated Crop Management (PTT). Tabela's specialty is not to plant transplants but the seeds are sown directly.

The consequence of Tabela is that the land requires different soil treatment and water management with the land for transplanting plants. Tabela is suitable to be applied in labor-less areas, short wet season, and irrigation water can be arranged. The most suitable location for the application of Tabela is agroecosystem of technical irrigation rice fields. However, in tidal, dryland and rainfed lowland agro-ecosystems it can also be applied on condition that water management and land preparation are done in particular.

In Tabela there is no making of nursery and move planting so it requires less labor. Directly planted rice will reach the generative stadia faster, shortening the rice production period and increasing the crop index. In areas with limited rainfall periods, Tabela rice cultivation may be avoided from drought or provide opportunities for cultivation other food crops.

Potential areas to implement Tabela include West Nusa Tenggara, East Nusa Tenggara, Kalimantan, Sumatra and Papua. Tabela is potentially developed with modern mechanization on a wide scale so as to increase productivity. Tabela technology as a reference for field officers, extension workers, farmers, and other users, consists of guidance on the implementation of the land to post-harvest handling. Tillage consists of selection of varieties and seeds, seed treatment, soil preparation, seed sowing, irrigation, weeding, fertilization, controlling plant pest organism (Pest), harvesting and post harvest handling.

Seed distribution technology evenly on the planting area is able to decrease the labor flow by about 28% (Hazairin and Manalu, 1993). But the main disadvantages of applying this method is the need for 2-3 times more seeds, as well as harvesting constraints due to the lack of spacing. The cultivation of direct seeding in the run does not significantly change the way the cultivation has been done so far because it keeps using the array with the spacing between the rows between 22-25 cm, depending on the varieties grown. The seed requirement in this way ranges from 50-60 kg / ha, or between 1.5-2 times compared to transplanting plants (Supriono and Milan, 1993).

Some improvements in the application of direct seeding in the run were done and found Tabela Legowo, rice planted in 4-6 rows, emptied 1 row planted again, 4-6 next row and so on. Research results from 1992-1994 in Balittan Sukamandi showed that two-line Legowo Tabela is the best, because rice production does not decrease, during rice growing season. How to cultivate the soil in the cultivation of Tabela rice in principle is the same as the cultivation of transplanting plants. To get the optimal result required perfect soil processing. Deep soil processing will accelerate the growth of plants so that plants do not easily fall on generative stadia. The surface of the soil should be evenly so that the water level can be controlled (Supriadi and Malian, 1993).

The technique of planting Tabela by using Atabela cultivation tools does not require a nursery as in moving cropping techniques. The seeds are

instantly soaked for 24 hours then dried for 12-14 hours and directly planted in the run. Seeds are used around 40 kg / ha while transplanting plants (taping) is only 25 kg/ha.

When compared between the use of planting ways to move by planting Tabela, then the ways of planting Tabela will provide several advantages, among others: Labor costs outside the harvest 25-30 percent lower, The cost of production means is 5-10 percent lower, The yield per hectare is 10-25 percent higher and the price of both grain and rice is higher (due to better quality) and Farmer net income increased from Rp. 1.2-1.5 million/ha/ season to Rp. 2.0-2.5 million/ha/season (Adnyana et al, 1997) (click the link below to read directly from the source.

2 RESEARCH METHODOLOGY

The research was undertaken on Direct Seeded Rice technology (Tabela) performance, particularly to test relevant factors affecting adoption of direct seeded rice. It was conducted in Langkat and Deli Serdang districts, consists of 2500 meter. The primary data collection is done through interviews with list assistance question (questionnaire) includes two growing seasons ie dry and wet seasons 2016/2017 year. To enrich the discussion, the description is equipped with secondary data from various related institutions. From the data, the resu;ted presentation into description and figure below.

Figure 1. Inpari 20 varieties using Tabela (Source: South Sumatera AIAT, 2014)

3 RESULTS AND DISCUSSIONS

3.1 Seed

3.1.1 Selection of Varieties and Seeds

Rice varieties used are high yielding varieties that have small number of tillers and are heavily neglected to prevent pests and diseases caused by high plant populations. Agro ecosystem of irrigated fields using superior varieties include Inpari 6, Inpari 9, Inpari 10, Inpari 13, Inpari 19, and Inpari 24. Agroecosystem of rainfed lowland uses Inpari 13, Batutegi, Situ Patenggang, Situ Bagendit, and Mekongga. Agroecosystem of dry land using Inpago 8, Inpago 9, Batutegi, and Situ Patenggang. Tidal agroecosystem using Indragiri, Mendawak, Banyuasin, Inpara 4, Inpara 8, Inpara 9, Inpari 20 (Figure 1), and Inpari 30 Ciherang sub1.

The seed of good quality and certification guarantees high vigor, uniformity of growth, pathogen-free and seeds, weeds, and not mixed with other varieties. Seed requirement on a Tablet (broadcast / sonor) system of 60-80 kg / ha, while Tabela in sequence and ATabela (drum seeder) require seeds 30-45 kg / ha.

3.1.2 Seed Treatment

Seed treatment aims to get pithy seed so as to produce a healthy plant. Pithy seeds are selected using a 3% salt solution or 30 grams of kitchen salt per liter of water. Seeds that float at the time of submersion are dumped and the drowning is the pithy seed that will be sown. Selected seeds are soaked in clear and clear water for 1x24 hours, then drained and immersed for 1x24 hours until the seeds begin to grow (Figure 2). The incubation is done by spreading the seeds over the tarpaulins evenly and then covered with a sack or a damp cloth. Tabela on dry land does not require soaking and curing of seeds. In the endemic areas of blast disease and Bacteria Leaf Blight (HDB), before sowing the seeds are treated with systemic pyroquilon or agrepdeng with 5-10 g / kg doses of seeds by way of soaking or coating.

Figure 2. Seeds begin to grow ready to sow (Source: Suwarno, 2014)

4 LAND PREPARATION, SOWING AND MAINTENANCE

4.1 Land Preparation

Irrigation field irrigation agroecosystems are subjected to perfect cultivation, covering singkal (wet) piracy or piracy (renewal), renewal, and land leveling measures. Wet-treated land is left for 1 week after hijacking with a water depth of 10-20cm. The cultivation is carried out by using the new / 'gelebeg' 1 week before land smoothing (Figure 3). After flattening, water is added agartanah moist so the land ready to sow. Prevention of standing water when sowing on the Tabela system plot is done by creating a worm channel surrounding the paddy fields and caren in the paddy field. Tabela technology in the array (ATabela) does not require caren in the map.

Irrigated rice paddies and rainfed rice fields with dry land, are pirated and renewed evenly. At the time of renewal can be added organic material in the form of compost or manure 2 ton / ha.Lahan left for 1 week then put water until soil moist and ready to sow. Typical B type tidal agroecosystem is done though wet soil or dried soil using hand tractor with plow depth less than 20 cm. Grounding is done 1 week after first tillage. The making of aqueduct (canal) surrounds the plot of land for micro-water

Figure 3. Garu / gelebeg pulled hand tractors in irrigated fields (Source: Firmansyah, 2014)

4.2 Sow the Seeds

In agro ecosystem of irrigated rice sowing is done on the condition of moist soil or not waterlogged. Tabela scatter (sonor / broadcast), seed sown evenly (Figure 4), while Tabela array with drum seeder spaced 25 cm between rows (Figure 5).

Figure 4. Sow seed (sonor / hambur) (Source: Zarwazi, 2013)

Figure 5. Sow seeds with drum seeder (Source: Zarwazi, 2008)

Seed sowing in rainfed agroecosystems avoids rainfall, whereas in type A tidal agroecosystems it is done by sowing (sonor) followed by sowing of husk ash. Tidal type B is done by seed sower (seed blower).

4.3 Irrigation

In irrigated wetland agro ecosystem, the land is kept moist and not stagnant for 10 days after sowing. Furthermore, the water is fed with a depth adjusting the height of the plant to a maximum depth of 5 cm. Where possible irrigation can be made. Type-T-type tidal agroecosystem, carried out with micro water management using a folder system.

4.4 Weeding

Figure 6 described the weed control is done mechanically and chemically. Glyphosate-based active herbicides were applied before tillage to kill all weeds. Selective pre-growth herbicides (pre emergence) are used at 3 days after seed sowing (DASS). Post-emergence selective herbicides are used at the time of 14 HSTb or when weeds are 2-4 strands. Tabela Lam and ATabela, in addition to using weed control chemistry methods can also be

done by manual or tool, such as gasrok (rotary hedgehog) and power weeder machine at the age of less than 21 DASS.

Figure 6. Weeding weeder (Source: Firmansyah-BB Rice, 2014)

4.5 Fertilization

Basic fertilizer application is done on 5-7 HSTb by using NPK fertilizer of 200 - 250 kg / ha. Fertilization of urea follow-up based on leaf color (BWD) reading done every 2 weeks (Figure 7).

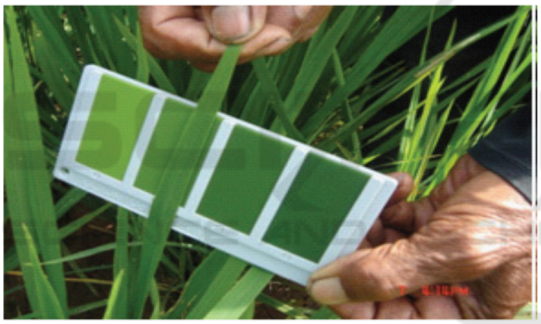

Figure 7. Leaf color chart (BWD) reading (Source: ICRR, 2014)

4.6 Pest Control

Monitoring/monitoring of pest populations was conducted 2 weeks before planting using light trap (lighttrap). Trap lights are installed at a distance of 15-20 m from the paddy field (Figure 10). Control is carried out according to the recommendation of Integrated Pest Management (IPM) by considering the economic threshold and the use of pesticides as recommended.

Insecticide granular active ingredient carbofuran amounting to 20 kg / ha is used in conjunction with the basic fertilization time. Rice borer endemic area using insecticide granules active ingredient carbofuran dose 17-20 kg/ha or spinetoram (dose 300ml/ha), rynaxypyr (500 ml / ha), tiametoxam + rynaxypyr (dose 250 ml / ha), and dymehipo (dose 600 ml / ha). Endemic areas of brown stems and white leafhoppers used insecticides with active ingredients of dinotifuran (1 mg/l concentration) or pymetrozine (0.5 g / l concentration). Trap Barrier System (Fig 8) full protection and massive gropyokan / fumigation (Figure 9) were performed in mouse endemic areas 2 weeks before and after sowing. Linear Trap Barrier System (LTBS) (Figure 10) is used to control rat migration.

Figure 8: *Trap Barrier System* (TBS) (Sumber: Anggara, 2012)

Figure 9: *LinearTrap Barrier System* (Sumber: Anggara, 2011)

Figure 10: Fumigasi dan penutupan *(LTBS)* & pemasangan bubu perangkap & pemasangan bubu perangkap lubang pasca fumigasi (Sumber: Anggara, 2013).

5 HARVEST AND HANDLING PASCAPANEN

Harvesting is done at the time of physiological rice cooking, with characteristic 95% of paddy grass is yellow. The rice harvest is manually done using a jagged sickle and a thresher (Figure 11) or mechanically using a harvesting machine (Figure 12). The harvested grain is dried with a drying thickness of about 5 cm and a reversal every 2 hours until the moisture content reaches 12-14%. Drying rice can also be done by using a sprayer tool.

Figure 11. Persiapan merontok gabah dengan *combine harvester* (Sumber: Firmansyah, 2015)

Figure 12: Panen padi dengan *power thresher* (Sumber: Rahardja, 2014)

5.1 Local Wisdom Communications Extension Tabela in North Sumatra

Increased national rice production today is based on efforts to increase productivity due to the expansion of areas on new lands facing various technical and socio-cultural constraints. Characteristics of farmers influence in receiving information from agricultural extension workers, such as through interpersonal communication through agricultural extension visits to individual farmers, group communication through plot demonstrations, and also through mass communication through brochures, posters, leaflets, manuals and electronic media (television, radio, internet). These communication forms are expected to accelerate the adoption process of location-specific agricultural innovations to support farming as well as TABELA (Norvasion, 2013). However, among the three forms of communication, interpersonal communication is the most appropriate and effective form of communication in terms of changing knowledge, opinions, beliefs, attitudes and behavior of farmers/communicants (Far, 2009).

Furthermore, the mastery of land resource technology, in this case TABELA in principle is a local wisdom that must be preserved from the farmers. Therefore, the mastery of information and agricultural innovation is needed by farmers so that the local wisdom is not eroded by social, economic and cultural factors. Farmers must have the character, among others, capable of high competitive, superior and competitive products, environmentally friendly, integrated with other sectors and meet market demand (Suwanda, 2008).

In addition to that, the role of specialist agricultural extension workers (PPS), agricultural extension workers (PPM) and agricultural field extension (PPL) is a matter that must be optimized so that the extension process to farmers in groups (farmer groups) run effectively in the understanding of information the same between each group member in the acceptance of new information or innovation. The effectiveness of counseling communications will give maximum results if implemented in a sustainable manner. In fact related to this, the government through the Ministry of Agriculture has launched a program of institutional development of farmer groups that received an intensive and continuous guidance from the government (Lubis, 1999).

6 CONCLUSION

The farmers' opportunity to apply (continue) the Tabela system is influenced by: (a) planting and maintenance costs, (b) escort by agricultural researcher extension, (c) season cropping, (d) the size of the laban's ownership, and (e) the location. Opportunity of farmers to continue Tabela tend to be higher with the increasingly high wages of workers for planting activities and maintenance. Similarly, the presence of escort researchers/agricultural extension will encourage farmers' opportunities to apply Tabela. The chance of Tabela's success is likely to be higher in the dry season as well carried out on the condition of land that irrigation is relatively good.

This is possible related to the type of rice varieties easy to fall down.

The policy implications of these findings are: First, Needed improvements to the superior varieties of bam suitable for the Tabela system (such as fall down). Second, Atabela needs to be designed with due regard to local laban conditions. Third, considering the cost of planting and maintenance (wage labor) is one factor determinants in adopting the Tabela system, application of Tabela is suitable to be prioritized its development to wilayal1 where there is a shortage of agricultural labor (farmers). Implementation of the Tabela system in these areas will suppress the need work force, which in turn will reduce the cost of meaningful farming increase farmers' income. Fourth, development requires Tabela support/guidance/escort from researcher/extension farmer due to socialization Tabela technology is still relatively bam. and it turns out from the results of this factual analysis still remains determinant for farmers to adopt the Tabela system

REFERENCES

Adnyana, M.O., K. Kariyasa, B. Rahmanto, F. Sulaiman, C. Muslim, A. Asikin, and Y.m Marisa. 1997. *Study Impacts on Agribusiness Development of Commodities.* Central Report Research So Agricultural Economics, Bogor.

Anonymous. 1996. *Aspect of cultivation and development of direct seed rice planting. Seminar on Analysis of Rice Based Farmers System (SUTPA).* Cisarua 2-4 April 1996. Agricultural Research Agency. Puslitbang Pertanian. Rice Research Institute Sukamandi. Subang.

Anwar, K., Andriati, A. Ruhnayat, Kendriyanto and Purwati. 1993. *Prospect of Rice Planting Spread Directly at Laban Irrigation.* Field Visit Report Report on Training Development Research Methodology and Procedures. Date April 26 - May 22, 1993. Agricultural Research Agency.

Bismar, S., S. Sankaran and S. Palaniappan. 1991. *Direct Seeding Practices in India. In: Direct Seeded Floded Rice in Tropics*. IRRI. Manila, Phillipines.

De Datta and Nantasomsaran. 1991. *Status and Prospect of Direct Seeded Flooded Rice in Tropical Asia. Direct Seeded Flooded Rice in The Tropics*, IRRI, Philippines.

Far R A F. 2009. *Relationship of Interpersonal Communication Effectivity with Behavior of Rice Field Farming (Case of Waimital Village of Kairatu Sub-district of West Seram District Thesis* Bogor Agricultural Institute: Bogor.

Gurning, T.M. 1995. *Direct spread of rice cultivation.* Rice Research Institute Sukamandi. Subang.

Haryadi, S. 1985. *Introduction to Agronomy*. IPB. Bogor

Hazairin and M. Manalu. 1993. *Rice Field Cultivation with Direct Spread Cam (Direct Seeding),* Bah Bolon Project. Cooperation between Indonesia and Australia.

Isaranurak, S. 1995. *Thailand Agricultural Systems.* Ministry of Agriculture & Cooperatives. Bangkok.

Lubis, Lusiana Andriani. 1999. *Decision Making Regarding Transfer of Rice Technology Continues In The Barisan in North Sumatra.* Thesis (S2). USM: Pulau Pinang.

Malian, A. H., A. Supriatna and H. Supriadi. 1995. *Economic Feasibility of Rice Cultivation Spread directly on the North Coast of West Java.* In Zaini, et al (Editor). System Food Crops-Based Farming. Comparative and Competitive Advantages. 74 Minutes of Seminar on Research Results of Farming and Socio-Economic System. Bogor. 4-5 October I994. Center for Food Crops Research and Development. Bogor.

Noor, E.S. 2008. *Acceleration of rice planting with Tabela system in the tertiary area of irrigation reservoir of the sublime forest.* Proceedings of National Seminar of Paddy 2008. Sukamandi.

Norvasion K. 2013. *Communication Effectiveness of Integrated Crop Management Extension Padi*. Skripsi. Bogor Agricultural University: Bogor.

Rawa Lawa Rice: *Guidelines for Agricultural Extension*. Agency for Agricultural Research and Development. Agriculture department. Jakarta.

Sriyani, N, Soesiladi, E. Widodo, M. Kamal, A. Karyanto, P. Setiawan, D.J. Sembodo, E. Pramono, M.S. Hadi. 1998. *Increased national rice production through paddy field cultivation system and less productive land use*. Proceedings of the National Seminar. Lampung 9-10 December. Indonesian Weed Sciences Association (HIGI). Komda Lampung.

Supriadi, H., and A. H. Malian. I. 1995. *Agronomic Feasibility of Rice Cultivation Technology Spread directly in Irrigated Rice Field.* In Sham, et al. (Editor). Food Crops Research. Book 3. Proceedings of the Plant Research Symposium Food III. Jakarta / Bogor 23 - 25 August I993. Research and Development Center Food Plant, Bogor.

Suryana, A., Suyamto, S. Abdulrachman, I.P. Wardana, H. Sembiring, and I.N. Widiarta. 2007. *Field Technical Guidelines Integrated Crop Management (ICM) Irrigated Wetland Paddy: Guidance for Agricultural Extension.* Agency for Agricultural Research and Development. Department Agriculture. Jakarta.

Suryana, A., Suyamto, H. Pane, Suwarno, B. Kustianto, A.K. Makarim, Sutrisno and H. Sembiring. 2007. *Field Technical Guidelines for Integrated Crop Management (PTT)*

Suwanda F N. 2008. *Communication Effectiveness Analysis Model Prima Tani As Dissemination of Agricultural Technology in Citarik Village, Karawang Regency of West Java.* Bogor Agricultural Institute. Bogor.