Improvement of cultivation techniques to increase sorghum productivity in Ende Regency, Indonesia

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Abstract. The sorghum crop has the potential to be developed in Ende Regency because it has wide adaptability and is tolerant to drought. Through proper processing, this commodity can be used as an alternative food for the people of NTT. Sorghum contains fibre that the body needs. Contains carbohydrates, nutrients, protein and vitamins. The main problem is the low productivity and income of sorghum farmers. This is because the cultivation technology is still conventional. Empowerment method used; counselling, training and mentoring. Technological improvements include tillage by ploughing once or twice and making beds. Overlapping sorghum with peanuts. The varieties used are Numbu, Suri 4, Super 1, Super 2, Soper 7 and Soper 9. Spacing Legowo 2: 1 where 2 rows of sorghum, 1 row of peanuts. Embroidery is done if the sorghum seeds do not grow. Fertilizers used, organic and inorganic, weeding at the age of 10-15 days, the second weeding together with the hilling, after the second fertilization. Pest control is carried out effectively. The application of cultivation technology affects increasing the productivity of sorghum.

1 Introduction

West Ondorea Village is a village located in Nangapenda District, Ende Regency, East Nusa Tenggara Province (NTT). The selection of West Ondorea Village as the locus of community service activities in 2023, considering that this village is one of the assisted villages of the University of Flores in carrying out research and community service activities. The distance of West Ondorea Village from the capital city of Ende Regency is 38.3 Km. Village potential and development surveys have been carried out since 2019, including a sorghum agribusiness development survey.

The life of the people of West Ondorea Village is very dependent on the agricultural sector, the commodities cultivated include; cocoa, horticultural crops and other food crops. One of the cultivated food crop commodities is sorghum. The superiority of sorghum lies in its

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broad adaptability, tolerance to drought, and higher resistance to pests and diseases compared to other food crops.

Sorghum is a cereal crop that has a high nutritional content, including carbohydrates, fat, calcium, iron and phosphorus. Sorghum flour has better benefits than wheat flour because it is gluten-free and has a low glycemic index of 46.8. Sorghum contains nutrients including 3.65% fat, 2.74% crude fibre, 2.24% ash, 10.11% protein and 80.42% starch. Sorghum also contains higher crude fibre than other types of cereals such as rice and wheat [1]. The benefits of sorghum for health care; are to improve the digestive system, and erode harmful cholesterol thus improving heart health, Sorghum seed coating contains antioxidants, sorghum has enzymes that can inhibit starch absorption by the body, and has high magnesium [1].

From sorghum, various creative culinary preparations were born, with delicious tastes and high nutritional content. Some people in Indonesia have used sorghum mixed with green beans and corn rice to overcome the stunting problem and made sorghum into sorghum fried rice, mixed sorghum rice, sorghum ice with its delicacy, and various processed wet and dry cakes [2]. Several regions develop sorghum as a sweetener in the form of soy sauce and sorghum crystal sugar, sorghum flour, nectar and sorghum rice.

Sorghum is expected to be an alternative food to overcome the problem of malnutrition for the people of West Ondorea Village in particular and the people of NTT in general. This is consistent with the characteristics of the province of NTT, dry land. NTT Province was once recorded as the area with the highest prevalence of stunting (under-five children due to chronic nutrition) nationally. There is not a single district/city in NTT Province, including Ende Regency, which is in the green or blue zone below 10%. Data obtained from the Ende District Health Office explains that the stunting prevalence rate in 2021 is 14.3% at the time of weighing or at least 2,775 toddlers are stunted.

The results of observations in West Ondorea Village showed that the productivity of sorghum plants was still low, at 2 tons per hectare. This phenomenon is no different from villages in Ende Regency which cultivate sorghum. National productivity has reached 3 tons per hectare, while in Lamongan Regency it has reached 6 tons per hectare [3]. This is influenced by the sorghum plant being used only as an intercrop from the main rice or corn crops, the use of inferior seeds and the cultivation technology is still very traditional; monoculture, irregular spacing, no fertilization and rarely done weeding. Regarding the use of fertilizers on sorghum plants, the results showed that the application of chicken manure at 13 tons per hectare on sorghum plants resulted in an average plant height of 277.08 cm, number of leaves of 15.69, leaf area of 8720.03 cm, wet stover weight 354.69 g, dry stover weight 249.38 g, panicle length 20.54 g, dry panicle weight 24.63 g, number of seeds per panicle 1392.19 g, weight 1000 seeds 7.50 g [4].

The priority problem found in West Ondorea Village, Ende Regency is the low productivity and income of sorghum farmers. These problems are handled by several activities including proper soil management, selection of appropriate varieties, analysis of seed needs, intercropping of sorghum with peanuts, improvement of plant spacing, fertilization, weeding and hilling, pest and disease control, good harvest and postharvest.

2 Method

The methods used include; methods of counseling, training, and mentoring. Counselling is provided to inform understanding, goals and benefits for partner groups. Training is provided so that participants are directly involved in the practice being carried out [5, 6]. The mentoring method is carried out after the training activities, to ensure partners carry out activities continuously and independently by the training material that has been provided. All partner
members mutually agree upon the implementation of the three methods. To measure changes in the increase in participants' knowledge and skills after participating in the training, a pretest is given at the beginning and a posttest at the end of the material [7, 8].

3 Results and Discussion

The partners involved in this community service activity are farmer groups and livestock groups in West Ondorea Village. There are 25 members of the farmer group and 20 members of the livestock group. The stages in providing problem-solving interventions for partners are firstly assistance in the form of procuring tools and materials including tools, rakes, hoes, buckets, chopping machines, waring and making compost houses. Ingredients include sorghum and peanut seeds as well as materials for making compost and bokashi fertilizer, plant residues, manure, sawdust, M4, sugar, rice bran and water [9]. Before counselling and training activities are given to members of farmer and livestock groups, the initial stage is given a pretest and ends with a posttest to measure changes in knowledge and skills. Similarly, to measure the attitude of members of farmer groups and livestock using a Likert scale.

3.1 Compost house.

The compost house is built permanently for livestock groups on customary land (owned by the chief) with a size of 4 x 6 meters. In the compost house, there are two tubs for the fermentation process. The first tub measures 1.5 x 2 meters with a height of 2 meters, while the second tub measures 1.5 x 2 meters with a height of 1.5 meters. The process of building a compost house takes 21 days. The compost house was built with the intention that all processes for making bokashi fertilizer and compost as well as the fermentation process can be carried out in the compost house.

3.2 Counselling and training on making organic fertilizers and improvement of sorghum cultivation techniques.

Counselling and training on the use of cereza plants as organic fertilizer. The cereza plants used come from leaves and grass or weeds resulting from land clearing. The cereza in the form of branches, twigs and leaves which are rather hard and wide are chopped, and then immersed in the mound that has been made, then the cereza is sprinkled with promi (microbial active ingredient) which has been mixed with water to speed up the decomposer process [11]. PROMI is a superior microbial formula that can decompose agricultural/plantation organic waste [12].

The people of West Ondorea Village are used to burning agricultural/weed waste at the start of the growing season. Discarded livestock manure, in the end, has an impact on environmental pollution (the smell of livestock manure). This happens because the knowledge and skills of the community are still very limited. Making compost is an alternative to the utilization of agricultural and livestock waste [13 - 15].

Compost comes from the fermentation process of agricultural waste materials and livestock manure. The decomposition process is accelerated. microbes at certain temperature conditions [16]. Making compost and bokashi is done in the compost house. Manufacturing process: water sugar and EM4 diluted with water, the ratio is 600 liters of water, 600 ml of water sugar and 300 ml of EM4. The active ingredient liquid is sprayed on the mixture of
manure, husks and bran evenly with a composition of 300 kg of manure, 150 kg of husks and 50 kg of bran and then stirred evenly. The dough that has been sprayed with the active ingredients is put in the first fermentation box for 7 to 14 days. Every two days the mixture is stirred aiming to neutralize the temperature in the fermentation box so it is expected that the decomposer process can take place optimally. After 7 to 14 days the mixture is transferred to the second fermentation box for 7 days, stirring every two days. After completing the process on the second box, bokashi fertilizer can be applied. Bokashi fertilizer obtained from the results of the training found the presence of white mould and did not smell rotten. The procedure for preparing this fertilizer and its odourless aroma is in line with the findings [17, 18]. Organic fertilizers can improve soil quality for sustainable agricultural development [19].

Intercropping is a way of growing more than one type of plant. This method is effective for increasing soil nutrient content thereby increasing the productivity of sorghum crops. [20]. Intercropping is a system of planting two or more types of plants simultaneously on the same land at the same time. In community service activities in West Ondorea Village, intercropping was carried out between sorghum and peanuts. The sorghum varieties used were Numbu, Suri 4, Super 1, Super 2, Soper 7 and Soper 9. The average land area of the 25 members of the farmer group was ± ¼ ha.

Peanuts are separated from the skin or peeled from the fruit skin, then the peanut seeds are selected, namely those that are healthy and not attacked by pests and diseases, then soaked in water mixed with seven (a chemical for controlling ants). The spacing used is 2: 1, where 2 rows of sorghum, and 1 row of peanuts. Setting the spacing in the intercropping system has a very important role in minimizing competition in obtaining growth factors, nutrients, water, sunlight and space to grow. Competition will occur if individuals from a plant group are present in another plant group, while growth factors are in limited conditions [21].

Hilling and weed removal are carried out in the sorghum and peanut plantations. The filling is done to strengthen plant stems, create loose soil conditions, and provide a better root environment for plants. Backfilling also aims to cover the roots of plants that appear above the soil surface, facilitate the absorption of nutrients in the soil and improve aeration (air circulation) while cleaning weeds has a very important role in minimizing competition for growth factors as much as possible which will hurt plant growth [21]. In connection with the improvement of cultivation techniques for sorghum in the gardens of 25 members of the farmer group in West Ondorea Village, the results showed that there was a significant change/increase in plant height, number of leaves, leaf area, weight of wet stover, weight of dry stover panicle length, weight dry panicles, number of seeds per panicle and, seed weight

4 Conclusion

Sorghum crop productivity can be increased through improved cultivation techniques based on science and technology, including; proper soil management, use of organic and inorganic fertilizers, application of intercropping cropping patterns, spacing of plants, cleaning of weeds and heaping up, proper control of pests and diseases. Farmers need to know the good varieties of sorghum, to get optimal sorghum productivity.

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