

Empowerment of Community with the Application of Compost on the Cultivation and Post-Harvest of Onion

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A B S T R A C T

Kenagarian (West Sumatra traditional village) Andaleh is located at the base of Mount Marapi in Batipuh Tanah Datar District, West Sumatra. The main livelihoods of the population are farming by planting rice, vegetable crops, ornamental plants, and cinnamon. In general, farmers in this location increase the yield of vegetables (onion) using artificial fertilizers. At this location, there are many *Tithonia* plants and agricultural waste. The solution was carried out by processing agricultural waste and plant into compost. Compost can increase the growth and the yield of onion bulbs. The objectives to be achieved in Community Service and Empowerment Program (KKN-PPM) activities are 1) Compost production using straw and agricultural waste and its application as organic fertilizer when mapping the red plotters, 2) Applying agricultural waste compost in the cultivation of onion 3) Processing the onion bulbs into the fried onion. The methods applied were debriefing students, counseling, training and demonstration plots with farmers. Activities that have been carried out are counseling about good onion cultivation, counseling about the benefits of organic fertilizer (compost) to 1) improve soil improvement and sources of nutrients for plants. 2) provide a training to make compost from straw and agricultural waste using Effective Microorganism EM-4, 3) support compost application in onion cultivation in farmers' fields and 4) inform the farmer to process fried onion.

1. INTRODUCTION

1.1. Research Background

Kenagarian Andaleh with (> 1000 m above sea level) is located in Batipuh sub-district, Tanah Datar District, West Sumatra Province. The main income of the population in Nagari Andaleh paddy, vegetables such as red chili, onions, and plantation crops such as coffee and cinnamon with good quality. Nagari Andaleh is also a producer of various beautiful flowers and is sought after by residents from other regions.

In addition, *Kenagarian* Andaleh is an area that is very potential to be developed as an agricultural and agritourism area. Nagari Andaleh is an area for developing ornamental plants and vegetables in Tanah Datar District. Considering that this area is visited a lot by domestic tourist, marketing of vegetables including onion becomes easier.

Onion is a daily necessity of the community and every household needs onions. The price of onions often educates especially on religious holidays and the end of the year. High price education can cause inflation. Cooking vegetables without onions is not good, so the price of expensive onions weighs

heavily on society. In West Sumatra, red onion plants are also widely planted. The center of red onion production in West Sumatra is in the nagari of the Nanam Alahan Panjang River in Solok Regency.

The main limiting factor in onion farming is the availability of superior / quality seeds that are still very limited, the intensity of attacks on pests and diseases that are high in certain seasons and environmental factors. Certified varieties of onion seeds are very necessary as the main requirement to ensure the production of onions.

The problem faced by farmers in *Keganarian* Andaleh, Batipuh Sub-district, is the dependence of farmers on the use of chemical fertilizers in crop cultivation including vegetables. There is often a scarcity of fertilizer because subsidized fertilizers are missing in the market, so farmers are difficult to maintain production. Fertilizers are also not always available according to the needs of farmers. Gradually the fertilizer subsidy will be removed so that farmers will be more difficult to meet their fertilizer needs.

The solution to these problems are: (1) The Raising Awareness Program among farmers about the importance of cultivating onions that are very much needed in everyday life; (2) The Increasing of the use of organic fertilizers Program due to the

availability of artificial fertilizers is increasingly limited because fertilizer subsidies will be reduced; (3) The Compost Producing Program from rice straw and agricultural waste using EM-4 microorganism activators through training and demonstration, (4) Demonstration plot of red onion cultivation technology by applying compost made by farmers; (5) Processing onions into fried onions.

1.2. Literature Review

1.2.1. Introduction

High rainfall is a cause of a decrease in onion production. Onions will produce a small amount of tubers when planted at the peak of the rainy season, because the risk of tuber rot is very large when harvested when rainfall is still very high [1]

To accelerate growth and improve crop yields, farmers generally use artificial fertilizers. Gradually the government will remove fertilizer subsidies, so the use of large amounts of fertilizer in farming will burden farmers. Sometimes chemical fertilizers are not available when needed and the price is quite expensive.

The habit of farmers in Nagari Andaleh is still burning straw after harvesting rice. In addition there are many agricultural wastes from vegetables. Farmers have not used rice straw and vegetable waste as fertilizer. The solutions offered are processing straw and vegetable waste into compost as an alternative to reduce dependence on the use of chemical fertilizers. To accelerate growth and increase yields, from our research, we have found an effective way to compost agricultural waste as organic fertilizer. One of potential plant which is found in *Kenegarian* Batipuh is *Tithonia*. This plant is used by local residents for animal feed. Meanwhile, *Tithonia* can be used as green manure or composted because this plant is rich in nitrogen content.

According to Ref. [2], the nutrient content of *Tithonia* is quite high, namely 3.16% N, 0.38% P and 3.45 5K. Furthermore Ref. [3] adds that in addition to containing nutrients N, P, and K, *tithonia* also has nutrient levels of calcium (Ca) 1.14%, magnesium (Mg) 0.78%, ratio C / N 13.96, lignin content 16.90% and cellulose 52.99%.

1.2.2. Onion

Onion is a superior commodity that is widely cultivated by farmers. This commodity can be used as spices, food and medicine flavoring. According to Ref. [4] because onion has a high economic value, onion cultivation has spread in almost all provinces in Indonesia. Onion contains protein, fat, carbohydrates, vitamins and minerals, and compounds that function as anti-mutagen and anti-carcinogens. For every 100 grams of onion tuber containing 80-85 g of water, protein 1.5 g, 0.3 g of fat, 9.3 g of carbohydrate [5].

Red onion plants include clumps of seasonal plants with fiber roots. The short stems are almost invisible with long cylindrical leaves. The base of the leaf changes its shape and function which is swollen to form a bulb and the tuber can form new shoots [1].

Although the actual onion plant is not a basic necessity, almost all household consumers need it as a supplement to their daily cooking spices. Lately, the demand for onions on the market has been increasing, but it cannot be balanced with the production of onions at the agricultural level. This is influenced by the productivity of land on agricultural land growing onions which

are increasingly decreasing due to excessive use of inorganic fertilizers which have an impact on soil structure damage [6].

Organic onion cultivation that is environmentally friendly is one solution to the dangers of using chemical fertilizers and synthetic pesticides that are excessive in this case the use is continuous. Organic agriculture appears as an alternative to modern agriculture by relying on natural ingredients and avoiding synthetic ingredients, both fertilizers and pesticides. The productivity of onions can be improved by improving cultivation techniques such as the use of mulch and fertilization. Ref. [7] states that fertilization activities need to be considered as well as the sources of fertilizers used because each fertilizer shows different effects on soil and plants.

According to Ref. [8] the optimum dose of N fertilizer, P, K, Bima Carut variety was 146 kg / ha N, 111 kg / ha P₂O₅ and 100 kg / ha K₂O with eskip dried tubers 25.77 tons / ha. The dosage of Bangkok varieties is 248 kg / ha N, 98 kg / ha P₂O₅ and 102 kg / ha K₂O with dried bulbs eskip 35.44 tons / ha.

Ref. [7] reported that there was an interaction between mulch and nutrient sources of nitrogen on the height of onion plants. The treatment of black and silver plastic mulch with nitrogen nutrient sources in the form of 2/3 N Urea + 1/3 N-ZA has higher plant height than nitrogen sources of N-Urea, 1/2 N-Urea + 1/2 N -ZA, and 1/3 N-Urea + 2/3 N-ZA. The treatment without mulch showed better growth and results compared to the treatment of black silver plastic mulch. Treatment of nutrient sources Urea and ZA tends to have the same effect on the growth and yield of onions.

Providing chicken manure is only able to increase plant height at the age of 2 MST. The interaction of treatment using various types of mulch and administration of chicken manure had no significant effect on all observational parameters [9]. Ref. [10] stated that mulch treatment had a significant effect on the intensity of *S. exigua* attack and not significantly on height plants and the production of onions.

1.2.3. Compost Application

Organic fertilizers generally contain low macro nutrients N, P, K but micro nutrients are sufficient for growth. Organic fertilizers prevent erosion and soil moisture [11]. According to Ref. [12], the provision of organic fertilizer can improve soil structure to be loose, increase CEC and increase water content in the soil. Continuous use of organic fertilizers over a period of time will make soil quality better than inorganic fertilizers.

The use of organic fertilizers without being accompanied by the use of organic fertilizers can adversely affect soil fertility [13]. One of the most used organic fertilizers is compost. Soil, compost and sand are mixed based on volume (v / v) 2: 1: 1 which, evenly mixed can be used as a medium for growing red chili in pots [14].

Ref. [15] stated that organic matter can maintain water availability, nutrients and microorganism activity in the soil, so that the organic material given can increase the weight of tubers produced on onions. According to Ref. [16], the composition of nutrients contained in 1 ton of rice straw compost is: 2.11% N; 0.64% P₂O₅; 7.7% K, 4.2% Ca, 0.5% Mg and Cu 20 ppm micro elements; Mn 684 ppm; Zn 144 ppm

Rice straw is an agricultural waste that is available in considerable quantities compared to other agricultural wastes, and is easily obtained to be used as animal feed and partly to compost [17].

The treatment of rice straw bokashi fertilizer affects the growth and production of onions. The best treatment was in the treatment of 3 kg / pot yielding the highest plant height of 35.11 cm, number of leaf leaves 10.44 strands, number of tillers tillers 6.67 tillers, production per plant 43.39 g and production per plot of 1.09 kg [18]. Ref. [19] used EM-4 in making thitonia compost to speed up composting process.. Besides that, for making compost from rice straw, *Trichoderma* sp has also been used.

Substitution of 50% chicken manure with 50 wheat straw compost gave the best results on plant height and fresh weight of onion plant bulbs. Analysis of wheat compost is 1.20% N, 0.4% P, 0.82% K, C-organic 12.19%, and C / N ratio 10.16 [20].

Composted straw which is immersed in soil has good nutrient elements for soil and plants with C-organic content 40 - 43%, N 0.5 - 0.8%, P 0.07 - 0.12%, K 1,2 - 7%, Ca 0.6%, Mg 0.2%, Si 4 - 7% and S 0.10% [21]. According to Ref. [22] the provision of 3 types of compost fertilizer namely cow manure, agricultural waste and cow dung + agricultural waste with a dose of 21 tons / ha gave an influence on the number of leaves, number of harvested tubers and fresh weight of tubers in harvesting higo stone varieties.

Providing compost of OPEFB compost at a dose of 5 tons / ha tends to show a better growth and production in parameters of plant height, number of tubers and weight of wet tubers / sample clumps [23]. While Ref. [15] stated that the provision of municipal waste organic fertilizer increased the highest number of tillers by 5.32 g while the lowest was found in the control treatment of 4.36 g) at the age of 3 weeks after planting..

1.3. Research Objective

The purpose of this KKN-PPM activity is to apply the technology of onion cultivation with the application of straw compost and agricultural waste which available around the location.

2. MATERIALS AND METHODS

The KKN - PPM activities are in *Nagari* Andaleh, Batipuh sub-district, Tanah Datar District. Students stay at the location for 40 days. Activities are divided into three steps: socialization, implementation and evaluation.

2.1. Debriefing and socialization to the community

Before students are sent to the KKN location - PPM is given debriefing by the resource person on the topic of onion cultivation and post-harvest, composting and application of compost on onion cultivation, farming analysis, entrepreneurship, packaging and marketing of onion products and customs. Implementation of KKN - PPM.

2.2. Implementation of KKN - PPM

KKN was conducted at the KKN - PPM location in nagari Andaleh, Batipuh district. activities carried out in the form of counseling, composting and demonstration of onion plots with compost applications and other activities.

2.3. Evaluation

Evaluation of activities is carried out during the activities and the activities are completed. evaluation was carried out on the onion demplot, how the growth and farmer groups carried out activities well or needed improvement.

3. RESULT AND DISCUSSION

3.1. Preparation and socialization to the community

Students who have been selected from various study programs and faculties at Andalas University are 25 people. Debriefing was carried out by the Andalas University Team and the Implementation Team. Before students are dispatched or deployed to the field, a field survey is carried out in Nagari Andaleh. After the meeting with Wali Nagari and Nagari devices in the Wali Nagari office we took a picture together with the *Nagari* local government officials in front of *Wali Nagari's* office Figure 1.



Figure 1. An official photo at the Wali Nagari Andaleh Office

3.2. Implementation of KKN Activities - PPM

The implementation of KKN - PPM begins with the departure of students to KKN - PPM locations accompanied by field supervisors. The Chairperson of the Implementing Team and members is a companion in this activity.

The field facilitator lecturer handed over the students to the KKN - PPM program to the Batipuh sub-district head and then delivered to Nagari Andaleh. In the Andaleh Nagari Student who was accompanied by a field supervisor was received by Wali Nagari at the Wali Nagari Andaleh Office.

In the Nagari guardian's office a workshop was held with guardian Nagari, Nagari and community leaders. After that, students are escorted to their respective lodging. Lodging is provided by the community and is free.

In this KKN - PPM activity counseling, assistance and demonstration of onions plots. Counseling was carried out on the technology of onion cultivation, making and application of compost from agricultural waste and processing onions into fried onions. Counseling of farmer groups and communities is carried out by field supervisors and KKN students - PPM. Students in this activity act as facilitators. In addition to the main activities also carried out counseling about ornamental plants with resource person from Andalas University. The Farmers Group engaged in ornamental plant cultivation requested an ornamental plant counseling through Local Government of Andaleh Village. Andaleh is a flower village, with some residents also cultivating seeds or cut flowers.

The extension activities and demonstrations on the packaging of vegetable products were also held. With this vegetable packaging, it is hoped that farmer groups and the community can implement it so that it will increase the value of these vegetables. Good packaging will increase storage power and can be marketed in the surrounding mini markets. Extension of demonstration on packaging of vegetable products is presented in Figure 2.



Figure 2. Extension of packaging demonstration Vegetables

3.2.1. Demonstration Plot

The demonstration of onion plots begins with soil processing, making beds and application of compost to the beds. Next the beds are closed with black silver plastic mulch. Giving mulch to maintain soil moisture and suppress weed growth. A week later the seedlings of onions were planted.

Plant growth and development in plot demonstrations are observed every week. Observations were made on plant growth, number of leaves, number of tubers, fresh weight of tubers and dry weight of tuber. The results of the observations are presented in Table 1-5.

3.2.2. Plant Height

From the analysis of variance, it can be seen that there is no interaction between the compost dose and the spacing of the onion plant height. This might be due to the high growth of the onion plant still going on. From Table 1, it can be seen that there is a tendency for the increasing doses of compost given (0 - 30 tons / ha of onion plant height increases).

Table 1. Height of onion plants in several compost doses and spacing of age 5 WAP (Weeks after planting)

Compost dose (ton/ha)	Spacing (cm)			Average
	25x20	25x25	25x30	
0	40.17	39.07	37.28	38.84
10	36.58	39.28	39.00	38.28
20	40.30	36.98	39.20	38.83
30	39.11	41.81	41.17	40.69
Average	39.04	39.28	39.16	

Coefficient of Variance (CV) = 8.57 %

Data on the same row and column is different not real according to F test 5%

Compost will improve soil structure and soil texture. The presence of compost will cause soil to loose so that

the roots of plants can easily expect water and nutrients in the soil. According to Ref. [24] states that organic matter can improve the physical quality of the soil so that it helps the development of plant roots.

Ref. [25] states that fertilizing onions needs to be done, both organic and inorganic fertilizers. Organic fertilizer given is compost of 10-15 tons / ha, while inorganic fertilizers used are Urea fertilizer 75 kg / ha, TSP 138 kg / ha and KCl 120 kg / ha.

The growth of composted onions plants showed a fairly good growth in plant height every week. The growth of onions from week 2 to week 5 can be seen in Figure 4. In the graph it can be seen that there is an increase in plant height every week in all compost treatments. Compost 30 tons / ha, the growth of onion plant height is faster than other treatments.

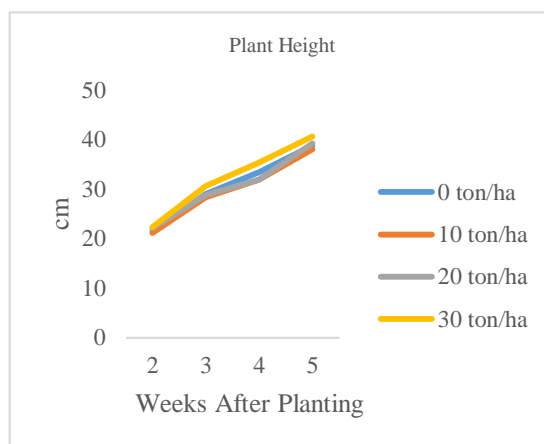


Figure 3. The height of onion plants on several compost doses at the age of 4 WAP

3.2.3. Number of Leaves

The results of the analysis of variance on compost doses, spacing and the interaction of the two showed different results that were not real. But there is a tendency to increase the compost dose to increase the number of leaves of onion plants by increasing the provision of compost fertilizer, where the number of leaves at 30 tons / ha is more than other treatments.

The effect of compost on the number of leaves at the age of 5 weeks after planting was not significant, it was probably due to the growth of slow leaf numbers. The number of leaves produced is quite a lot. For Medan varieties the number of leaves ranges from 22 to 46 strands. In this experiment the number of leaves at the age of 5 weeks after planting has reached the description of 29 - 42 strands. The results of the Ref. [18] study, the number of onions given 3 kg / pot of rice straw was only 10.44 pieces per clump. In this experiment there were more leaves and up to 42 pieces per clump.

Table 2. The number of leaves of onions in several compost doses and spacing of age 5 weeks after planting.

Compost dose (ton/ha)	Spacing (cm)			Average
	25x20	25x25	25x30	
0	35.22	35.00	29.16	33.13
10	29.39	33.55	36.06	33.00
20	38.94	31.39	33.16	34.50
30	33.33	33.83	41.56	36.24
Average	34.22	33.44	34.98	

CV = 15.42 %

Data on the same row and column is different not real according to F test 5%

The growth in the number of onions increases every week. The growth of the number of leaves in each compost treatment from 0 - 30 tons / ha is almost the same trend. The increase in the number of leaves increases sharply in weeks 2 to 5 after planting. Composting of 30 tons / ha shows the highest number of leaves (Table 2).

3.2.4. Number of Bulbs

From the analysis of variance on the number of tubers there is no interaction between compost doses and spacing. Giving compost with different compost doses and different spacing gives a response to almost the same number of tubers.

Table 3. Number of Bulbs on onion plants in several compost doses and spacing

Compost dose (ton/ha)	Spacing (cm)			Average
	25x20	25x25	25x30	
0	14.07	13.2	13.07	13.44
10	12.67	10.93	12.8	12.13
20	13.4	12.27	11.27	12.31
30	12.33	13.87	13.73	13.31
Average	13.12	12.57	12.72	

CV=29.18 %

Data on the same row and column is different not real according to F test 5%

3.2.5. Fresh Weight Bulbs

The weight of onion bulbs in the treatment of several compost doses and plant spacing showed almost the same results. Fresh weight of tubers per clump ranges from 136.00 - 181.30 g.

3.2.6. Dry weight of bulbs

Analysis of variance on the bulb dry weight did not show the interaction between compost dose and spacing. Spacing does not affect the dry weight of onions. Giving compost at different doses affects the dry weight of onion bulbs. The highest tuber weight of 130.40 g per clump was obtained from compost with the highest dose of 30 tons / ha.

Table 4. Fresh weight of red onion bulb in several compost doses and spacing

Compost dose (ton/ha)	Spacing(cm)			Average
	25x20	25x25	25x30	
0	163.3	149.3	145.3	152.7
10	136	152	142.7	143.6
20	168.7	150.3	153.3	157.4
30	155.3	168.7	181.3	168.4
Average	155.8	155.1	155.7	

CV= 31.65 %

Data on the same row and column is different not real according to F test 5%

Table 5. Dry weight of red onion bulb in several compost doses and spacing.

Compost dose (ton/ha)	Spacing(cm)			Average
	25x20	25x25	25x30	
0	132.20	112.30	117.00	120.60 AB
10	106.70	122.30	117.00	115.30 B
20	135.70	124.00	130.30	130.00 AB
30	126.10	134.00	155.00	138.40 A
Average	125.20	123.20	129.80	

CV =32.21 %

Data on the same row followed by the same uppercase letters is non-significantly different

From Table 5 it can be seen that the increase in compost doses increases the dry weight of onion bulbs. Provision of compost can improve soil structure so that the soil becomes loose so that root development is better so that nutrient uptake by the roots is better then the onion bulbs become bigger and the weight becomes heavier. Fertilization activities also need to pay attention to the source of fertilizer used because each fertilizer has a different influence on soil and plants [7].

In the demonstration plot, black silver plastic mulch was used. Mulch application is an effort to suppress weed growth, modify the balance of water, temperature and soil moisture and create conditions that are suitable for plants, so that plants can grow and develop well.

3.2.7. Production of fried onions

Processing onion bulbs into fried onions is also carried out. The post-harvest activities were carried out by supervisors, students of KKN - PPM and KWT Surba and KT Elok Basamo Saiyo. People are interested in this activity and want to try it for themselves. Fried onion products can be seen in Figure 5.



Figure 5. Red onion products in packaging

4. CONCLUSION

From the results of the KKN - PPM program activities it can be concluded that: (1) Increased awareness and empathy of students towards problems faced by the community such as onion cultivation; (2) The presence of onion demplot encourages people to be able to implement it themselves, (3) Charity gives a positive response by following all activities to the end; (4) Processing onions into fried onions will provide added value and increase sales value so that farmers' income also increases. From the results of this activity, it is expected that farmer groups and farming communities in the Andaleh village will apply the onion cultivation and processing technology that has been demonstrated.

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