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Research Article

Productivity of peanut at abandoned pumice mining land in West Nusa Tenggara, Indonesia

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Abstract: Four packages of peanut technologies, PTB1 (soil tillage, certified seed, dibbling with 40cmx10cm and 2 seeds/hole, seeds treatment, fertilizer 200 kg/ha Phonska (NPK fertilizer), and pests control with IPM methods), PTB2 (similar to PTB1 except for no seed treatment and fertilizer of urea for 50 and SP36 for 100 kg/ha), PTB3 (similar to PTB2 except for 40x15cm spacing and fertilizer of urea 50 kg/ha), and PTP (famer practice, uncertified seeds, irregular spacing, no seed treatment, no fertilizer, and no pest control) were examined the agronomic adaptability and economy value in pumice stone mining land at the Akar-akar Village of North Lombok District. Each package that was applied on an area of 0.5 ha was repeated three times at different farmers group. Economic analysis was performed to obtain revenue over variable costs (RAVC) and marginal benefit cost ratio (MBCR). The results showed that the highest fresh pod yield (4.50 t/ha) and the highest dry pod yields (2.30 t/ha) were observed for PTB1. These values, however, did not significantly different from those of other PTP treatments. The lowest fresh and dry pod yields were observed for at PTP treatment and these were significantly different from all PTB treatments. The highest of net income of farmers from the application of package of technologies was obtained from the PTB1 (Rp 8.970.00), while the highest MBCR value was obtained from the PTB3 (5.51). This indicated that the PTB3 was the promising peanut package of technology that may be applied on abandoned pumice stone mining land.

***Keywords**: abandoned pumice stone mining land, peanut productivity, technology packages,*

Introduction

Pumice stones are industrial minerals that are quite important in the industrial sector. Pumice stone is a result of a volcano activities with a porous structure composed of silica, alumina, ferrioxide and it comes with various colours such as white, bluish gray, dark gray, reddish, yellowish or orange. However, pumice mining that has been carried out since 1980s has brought about environmental damage. A number of studied on the environmental problem caused by mining industry have been reported by several researchers (Jayadi, 2008; Mossa and James, 2013). Sholihah and Sjarmidi (2014) reported that the environmental problems caused by mining industry including pumice mining were severe such as critical condition with low level of soils stability, water infiltration, poor soil macronutrient content and landscapes more vulnerable to erosion, floods, subsidence, and other een geomorphic hazards. Studies to improve soil and environment conditions of pumice mined land have reported by many researchers (Juhadi, 2007; Asir, 2013; Sholihah and Sjarmidi, 2014). However, study of peanut productivity at abandoned pumice mining land with package of technologies that are easy to be applied by farmer is very limited.

Peanut (*Arachis hypogaea*) is one of the food legumes and vegetable oils that is generally grown by small farmers as the main source of household income and source of vegetable protein for the rural population (Jogloy et al., 1992). Despite the availability of 160000 ha land in West Nusa Tenggara Province that is potentially suitable for peanut cultivation (BPS NTB, 2008), farmers face problems in the implementation of peanut farming because of lack of knowledge about peanut farming technologies such as plant population, pest/disease and weed, and fertilization (Saleh and Adisarwanto, 1996; Harsono, 1996; Wirajaswadi, 2008). Moreover, peanut farming in abandoned pumice mining land usually is cultivated in dryland climates which generally depend on rainfall conditions. Thus, the availability of peanut package of technologies that may be resilience to arid climate and suitable to abandoned pumice mining land will improve the productivity of peanut.

Considering the end users of the technology package in abandoned pumice mining land is dryland farmers with all the limitations of resources and managerial capabilities, then the package of technology must be tested in farmer's field. This effort is important to provide farmers with ready peanut package of technologies that can be applied to the field. Nigam and Gowda (1996) asserted that the success of a technology is determined by the ability to adapt and adoption by farmers.

It is recognized that the technology package for peanuts in abandoned pumice mining land is very limited compared to packet technology for other agroecological zone such as in irrigated land. In addition, testing the peanut package of technologies was not just to determine the suitability of these technologies in the wider environment, it also give opportunities for farmers and researchers to make modifications as necessary so that the technology package can really solve the problems of priority (Gendel et al., 2001). The aim of the study was to identify the peanuts technology packages with the best agronomic adaptability and economy in pumice stone land mining.

Materials and Methods

The experiment was conducted at Akar-Akar Village, Bayan Subdistrict North Lombok District on wet season and planted on January 2012. Soil of the experimental site was developed from volcano ashes from eruption of Rinjani Mountain, solum depth varies from 25-35 cm to more than 1 m with make the land potential for peanut cultivation. The soil has the following characteristics: pH (H_2O) 6.1; 0.92% organic C; 0.14% total N; 97.02 mg/kg available P; 31.57 mg/kg available K; 5.8 mg/kg available Fe; cation exchange capacity 2.42 cmol/kg; and 52% sand, 40% silt and 8% clay. There were four of peanut technology packages studied as treatments (Table 1). The field experiment was laid out in a randomized block design with an on-farm research approach, which was conducted in farmers' fields actively involving farmers from planning to evaluation of performance of the peanut technology packages. The treatments were replicated three times with farmer groups as replication/block. Each farmer group applied four peanut technology packages on an area of 0.5 ha for each package. Thus, the overall study was conducted on an area of 6.0 ha.

Table 1. Treatments of peanut technology packages studied on abandoned pumice stone land in North Lombok, West Nusa Tenggara, 2012

Component of package	**New packages of Technologies of Peanut (PTB)**			**Farmer Practices**
	PTB1	PTB2	PTB3	**(PTP)**
Land preparation	Complete soil tillage	Complete soil tillage	Complete soil tillage	Complete soil tillage
Seed Quality	Certified seed	Certified seed	Certified seed	No certified seed
Variety	new	new	new	Local
planting	dibbling	dibbling	dibbling	Placed in furrows
Plant spacing and no seed/hole	40cm x 10cm, 2 seeds/hole	40cm x 10cm, 2 seeds/hole	40cm x 15cm, 2 seeds/hole	irregular
Seed treatment	With kaptan	No treatment	No treatment	No treatment
Fertilizer/ha	200 kg NPK Phonska	50 kg urea + 100 kg SP36	50 kg urea	No fertilizer
Weeding	Depending on weed growth	Depending on weed growth	Depending on weed growth	Farmer practices
Pest and diseases control	Integrated pest management approach	IPM approach	IPM approach	No protection

Data were collected at the harvesting time and measured for total pods weight, old pods weight, young/damaged (broken) pods weight, dry pods weight. Peanut was harvested at physiological maturity and expressed at 11% moisture content. A 4m x 2m area within each farmer block was used to sample yield components and estimated in kg /ha. Data to calculate economics parameters of this study was obtained from farm record keeping (FRK) where each farmer has the FRK to record all activities of farmers during peanut growth period starting from land preparation to harvesting and saling.

The data were statistically analyzed by analysis of variance, if there are real differences between treatments were further tested by Duncan's Multiple Range Test (DMRT). Revenue Over Variable Costs (RAVC) and Marginal Benefit Cost Ratio (MBCR) of the application of technologies were calculated to determine the economic feasibility of the technology (Banta and Jayasuriya, 1999).

Results and Discussion

Soil properties

The pH status of soil was in the range of neutral which is suitable for peanut cultivation (Taufiq and Rahmiana, 2008) with high contents of phosphorus and potassium availability. However, N and organic carbon content of soil were low that was a characteristic of soil in post mining land (Mitsch and Jorgensen, 2004). Soil texture in the experimental site was dominated sand and silt fractions with very small portion of clay fraction. This proportion of soil texture may be suitable for peanut growth. Soil condition suitable for peanuts growth is mainly light textured of sandy loam soil, with sand and silt fractions are relatively balanced and low clay fraction, which makes good enough for seed germination, penetration of pods candidate (*ginofor*) into the ground and preventing the pods left at the time of harvest (Saleh and Adisarwanto, 2006; Taufiq and Rahmiana, 2008).

Productivity of peanut

The level of peanut productivity is a general indicator to measure performance of technologies packages. The productivity of peanut under varies packages of technologies is presented in Table 2. There was significant different of yield components between PTB and PTP, in which yield component in all PTB treatments were higher than PTP (farmer practices). However, there were no significant different amongst PTB treatments, indicating that all new technologies studied has contributed to a better performance of peanut.

The highest pods yield was obtained from PTB1 although this was not significantly different from PTB2 and PTB3. This indicated that the different in component technologies application of PTB including plant spacing and number of seeds/hole, type and dose of fertilizer and crop protection did not significantly affect the yield components of peanut. These result were supported by the study of Wirajaswadi (2008) conducted in rainfed area of Sekotong of West Lombok District that fresh pods yield of peanut fertilized with a combination of N, P and K fertilizers and manure was not significantly different. There was no significant different of seed rendement caused by all treatments. This indicated that moisture content at physiological maturity of pods was similar.

Table 2. Fresh pod yield, rendement and dry pods of peanut at various treatment in Akar-Akar, Lombok Utara, January 2012

Treatments	Fresh pods (t/ha)	Rendement (%)	Dry pods (t/ha)
PTB 1	4.50 a	51.10 a	2.30 a
PTB 2	4.40 a	49.18 a	2.20 a
PTB 3	4.17 a	48.50 a	2.00 a
PTP (control)	2.48 b	50.94 a	1.30 b

Total pods. Old Pods and Young/Broken Pods

Total pods. old pods and percentage of young or broken pods of peanut at various treatments are presented in Table 3. Total pods. old pods and proportion of young or broken pods of peanut determine the level of peanut yield. The high number of pods and old pods obtained per hole may lead to high yield. Table 3 shows that there was no significant difference on pods total of all treatments. except for old pods and percentage young/broken pods between PTB and PTP. in which number of old pods per hole PTB was higher than that in PTP. In addition. percentage of young and broken pods in PTB was lower than that in PTP. In general. there was no effect of components of technology applied in PTB on total pods. old pods and percentage of young/broken pods per hole. This indicated that application of any package of these technologies will increase the yield and yield component of peanut compared to PTP.

Table 3. Total pods. old pods and percentage of young/broken pods of peanut at varies treatments

Treatments	Total Pods (pod/hole)	Old pods (pods/hole)	Young and broken pods (%)
PTB1	17.3 a	14.4 a	22.9 b
PTB2	17.6 a	14.7 a	22.7 b
PTB3	18.0 a	14.5 a	24.8 b
PTP (control)	15.5 a	10.8 b	30.4 a

Seed and weight of 100 seeds of peanut

Seeds represent the net yield of peanut cultivation although farmers rarely sale peanut yields in the form of seed. However. determining seed yield is important in order to quantify seed demand and seed production. Seed yield. seed rendement and weight of 100 seeds of peanut at various treatments in Akar-akar Village of Subdistrict of Bayan. North Lombok are presented in Table 4. Seed yield. seed rendement and 100 seed weight varied with treatments. The highest seed yield was found in PTB1. Although this was not significantly different with PTB3. this was significantly different with PTB2 and PTP. The lowest seed yield was found in PTP treatment that was significantly different with all new peanut package of technologies. The statistical difference of seed rendement was similar to seed yield. However. there was no significant different for 100 seed weight induced by new package of technologies except by PTP (farmer practice). The 100 seed weight in PTB treatments was higher than in PTP treatment. indicating that the quality of seed caused by PTB treatments was better than farmer practice. Any package of peanut technologies applied will make better quality of seed.

Table 4. Seed yield. seed rendement and 100 seed weight at various treatments in wet season 2011/2012 at Akar-Akar Village of North Lombok District.

Treatments	Seed Yield (t/ha)	Rendement of dry pods to seed (%)	100 seed weight (g)
PTB1	1.54 a	67.1 ab	56.3 a
PTB2	1.36 b	61.6 b	57.7 a
PTB3	1.41 ab	70.7 a	57.3 a
PTP (control)	0.80 c	61.7 b	40.0 b

Economic analysis and feasibility of peanut packages of technologies.

The main consideration for the farmers to accept or adopt the new technology is the economically high benefit including the level of net income. low application cost. high cost efficiency and easily marketed.Technology package that agronomically improve the peanut productivity may not necessarily be accepted by farmers unless it has given sufficient net income. Thus. agronomic assessment relates only to the technical aspects of peanut culture and will be more useful if it is followed by an economic analysis. The adoption of technology by farmers may be felt due to luck of the technology package of peanut in demonstrating the economic advantage.

The results of economic analysis showed that the technology package with the highest productivity and able to generate the highest net income may not necessarily be the most feasible to be applied from the economic aspect (Table 5). It appears that the more technology component of peanut applied. the higher cost will be required. In PTB treatments. the highest production input was found at PTB1 treatment. followed by PTB2 and the lowest was found at PTB3. Production input in PTP (farmer’s practices) was higher than PTB3 because of the higher seed used. Similar trend of labour cost and total cost were observed for all treatments with PTP treatment was the lowest labor cost. It is shown that high cost may proportional to high output reflected in gross income and net income. The highest net income per hectare was obtained on application of PTB1 for RP 8.97 million. followed by PTB2 for RP 8.5775 million and PTB3 for RP 8.264 million and the lowest was obtained from the PTP treatment for RP 3.761 million (Table 5). Similar trend to net income was found for gross revenue.

The highest B/C ratio was found at PTB3 followed by PTB2 and PTB1. and the lowest B/C ratio was found at PTP for 0.74 (Table 5). Similar trend to B/C ratio was found at MBCR values. This indicated that although the net income was found at PTB1. but the highest B/C ratio and MBCR value was found at PTB3. indicating that the high income is not always followed by the high cost efficiency. Banta and Jayasuria (1999) stated that the new technology is considered to be economically viable if it has a value of MBCR at least 2.0 and B/C value at least 1.0. Although PTB1 provide the highest net income. it seems to be less economically viable than PTB2 and PTB2. While the application of the PTP may not economically viable as it has shown to be very low net income and B/C (0.74). Thus agronomically and economically. PTB3 is the most feasible technology to be applied by famers as its productivity was not significantly different from PTB1 and PTB2. while it gave the highest value of MBCR.

Table 5. Economic analysis of peanut package of technologies applied in Akar-Akar Village. Bayan Subdistrict of North Lombok District in 2012

No	Variables	PTB1	PTB2	PTB3	PTP
		…………………...……..(Rp) ……………………			
A	Production inputs	2.230.000	1.817.500	1.295.000	1.480.000
B	Labour	4.900.000	4.725.000	4.581.000	3.579.000
C	Total cost (A+B)	7.130.000	6.542.500	5.876.000	5.059.000
D	Gross revenue	16.100.000	15.120.000	14.140.000	8.820.000
E	Net income (D – C)	8.970.000	8.577.500	8.264.000	3.761.000
F	B/C	1.26	1.31	1.41	0.74
G	Marginal B/C	2.51	3.25	5.51	---

Conclusion

New peanut package of technologies (PTB) have increased the productivity far over the productivity of peanut in farmer practice (PTP). The high productivity may directly proportional to the high net income. but it may not be followed by the value Marginal Benefit Cost Ratio (MBCR). New peanut technologies package of PTB3 may be a technology package of peanut cultivation under abandoned pumice mining. which has agronomically and economically feasible to be applied by famers.

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