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Effect of rice husk mulching on germination percentage, yield and economics of pea (*Makhyatmubi*) *Pisum sativum* L.

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ABSTRACT

Mulch can effectively minimize water vapour loss, soil erosion, weed problems and nutrient loss. Modification of soil microclimate by mulching favours seedling emergence and root proliferation. Organic mulches add nutrients to the soil when decomposed by microbes in the soil. A field experiment was conducted during the rabi season of 2018 and the treatments comprised of one control (T_1-no mulch) and six levels of rice husk mulching *viz*, T_2(10q/ha), T_3(20q/ha), T_4(30q/ha), T_5(40q/ha), T_6(50q/ha)and T_7(60q/ha) were laid out in RBD with three replications. The application of rice husk mulching 60q/ha (T_7) had significant effect on the germination percentage of the crop. The highest number of pods, pods per plant and longest pod length were recorded in the treatment of rice husk mulching with 60q/ha (T_7). The test weight was found to be non-significant. With respect to economics of yield production in pea, higher gross returns, net returns and returns per rupee invested (B:C ratio) was obtained by 60q/ha rice husk mulching as compared to the other treatments. From the present investigation it was observed that pea was found to perform better in rice husk mulching of 60q/ha.

Key words : *Pea, Rice husk, Mulching, Yield and economics*

Introduction

Pulses are generally rich source of proteins and are healthy and nutritious. Growing of pulse crop promotes sustainable agriculture, increases soil health and water use efficiency is high. Pulses occupy a unique position in agricultural economy by virtue of their ability to fix nitrogen in symbiotic association with *Rhizobium*. Pea (*Pisum sativum* L.) belongs to the family Leguminosae; it is a well-known and important pulse crop of India grown during *rabi* season. The ideal temperature is between 10 °C and 30 °C with an optimum temperature of 20 °C. For emergence, vegetative and reproductive stages of pea a threshold or base temperature of 3 °C, an optimum of 28 °C and a maximum of 38 °C are appropriate as cardinal temperatures. Pea is an important crop grown in Manipur. There are different types of peas grown in Manipur. Among them, Makhyatmubi is one of the most popular local cultivars under garden pea (*Pisum sativum* L. subsp hortense). During peak period, the market rate of green pods of Makhyatmubi is high (780-100 per kg.) and the grain is 300 per kg and even more during off seasons. Therefore, growing of pea can earn profitable income to the farmers. Mulches are used for various reasons in agriculture but water conservation and erosion control are the most important objectives. Mulching reduces the deterioration of soil by way of preventing the runoff and soil loss, mini-

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mizes the weed infestation and reduces water evaporation. In addition, mulch can effectively minimize water vapor loss, soil erosion, weed problems and nutrient loss (Van Derwerken and Wilcox, 1988). Modification of soil micro climate by mulching favours seedling emergence and root proliferation and suppresses weed development in the field. Organic mulches are efficient in reduction of nitrates leaching, improve soil physical properties, prevent erosion, supply organic matter, regulate temperature and water retention, improve nitrogen balance, take part in nutrient cycle as well as increase the biological activity, Hooks and Johnson (2003). In this experiment, we used rice husk as mulching material which is easily available and cheap in Manipur.

Materials and Methods

The experiment was carried out during the *rabi* season of 2018 at the experiment field of College of Agriculture, CAU, Imphal. The soil was clayed, acidic (pH 5.5) and available N, P_2O_5 and K_2O (254.24, 12.17, 221.41 kg/ha) are all medium. The organic carbon content was high (1.3%). The experiment was laid out in RBD with three replications. The treatments were T_1-without rice husk mulching (control), T_2, T_3, T_4, T_5, T_6 and T_7 with rice husk mulching of 10 q/ha, 20 q/ha, 30 q/ha, 40 q/ha, 50q/ha and 60 q/ha respectively. The selected seed for the experiment was garden pea (*Pisum sativum* L. subsp. hortense, local cultivar-*Makhyatmubi*. During the period of experimentation, a total of 212.4mm rainfall was received. The range of monthly maximum and minimum temperature during the crop growth period was 27 °C to 21.8 °C and 13.5 °C to 6.5 °C respectively. The germination percentage is obtained from the total number of seeds sown and number of seeds germinated. Five plants in each plot of the experimental field were randomly selected except the border rows and tagged for taking observations. Seed yield were recorded in kilogram and expressed in quintal per hectare.

Results and Discussion

Effect of rice husk mulching on germination percentage

The data on the germination percentage were recorded on the on the 5th and 10th days after sowing (Table 1) on the 5th day, the germination percentage in pea crop did not differ significantly between the treatments due to mulching. However, on the 10th day the germination percentage was significantly higher (84.67%) in the treatment with 60 q/ha rice husk mulching (T_7) which is at par with T_6 (84.10%) and T_5 (83.50 %) and the lowest germination percentage (77.15 %) was recorded in the treatment with no mulching (T_1). The maximum germination observed in mulched condition could be due to optimum temperature, favorable moisture content and suitable climate for better germination of the pea plant. The result was in agreement with Rajesh *et al.* (2015).

Effect of rice husk mulching on pod length, number of pods per plant, number of seeds per pod, test weight and yield

Pod length was significantly influenced by rice husk mulching (Table 1). The maximum length of pod (7.53cm) was observed in the treatment of rice husk mulching with 60q/ha (T_7) which is at par with rice husk mulching of 40q/ha (T_4-7.03cm) and 50q/ha rice husk mulching (T_5-7.37 cm). However, the minimum length of pod (6.0cm) was recorded in the treatment with no mulching (T_1). The increase in pod length may be due to conservation of enough moisture, suitable soil temperature and microclimatic condition of the soil which enhance the vegetative growth of the plants due to mulching and subsequently, increasing the pod length. The results were in line with the findings of Nagalaxmi *et al.* (2002). It is evident from Table 1 that mulching with rice husk had significant effects on the number of pods per plant. There was increase in number of pods per plant with the increase in the level of rice husk mulching. Significantly higher number of pods per plant (7.23) was recorded with rice husk mulching of T_7 which was at par with rice husk mulching of T_5 and T_6 from the rest of the treatments. While significantly lower number of pods per plant (T_1-4.93) was recorded in treatment with no mulching. The increase in the number of pods per plant could be due to the conserved amount of water on mulched plot which was essential for biological and physiological process of the plant. These results were also in line with the findings of Sajid *et al.* (2013) and Choudhary (2015). Observation of Table 1 showed the number of seeds per pod varied significantly due to rice husk mulching. The highest number of seeds per pod (6.33) was recorded with rice husk mulching of T_7 which was at par with rice husk mulching of T_4 and rice husk mulching of T_6

Table 1. Effect of rice husk mulching on germination percentage (%), pod length, number of pods per plant, number of seeds per pod, test weight and yield of pea

Treatment	Germination percentage (%)		Pod length (cm)	Number of pods per plant	Number of seeds per pod	Test weight (g)	Yield (q/ha)
	5th day	10th day					
T_1	57.37	77.15	6.00	4.93	5.20	243.03	10.30
T_2	58.67	80.67	6.42	4.97	5.30	249.00	11.75
T_3	57.33	81.50	6.77	5.03	5.47	251.67	12.05
T_4	59.03	82.33	6.90	5.60	5.74	242.67	12.65
T_5	58.67	83.50	7.03	6.33	5.77	257.67	13.09
T_6	58.48	84.10	7.37	7.17	6.10	253.00	14.13
T_7	60.00	84.67	7.70	7.23	6.33	258.33	14.74
S.Ed(±)	2.53	1.28	0.35	0.45	0.25	9.19	0.38
CD (at 5%)	NS	2.80	0.77	0.99	0.54	NS	0.82

T_1-Without rice husk mulching (control), T_2-10 q/ha of rice husk, T_3-20 q/ha of rice husk, T_4-30q/ha of rice husk, T_5-40 q/ha of rice husk, T_6-50 q/ha of rice husk, T_7-60 q/ha of rice husk

while significantly lower number of seeds per pod (5.20) was noticed in treatment with no mulching. The higher number of seeds per pod obtained in the higher levels of rice husk mulching could be due to more moisture conserved in the soil which consequently facilitates the translocation of assimilates from the source to sink. This in line with Ozkan and Kulak (2013), who reported higher number of seeds per pod in sesame under higher moisture content and lowest under water deficit condition.

The grain yield varied significantly due to mulching with rice husk in pea. The highest grain yield (14.74 q/ha) was observed in rice husk mulching with 60 q/ha which was at par with rice husk mulching of 50 q/ha with grain yield of 14.13 q/ha. However, significantly lower grain yield (10.30 q/ha) was observed in the treatment with no mulching. The grain yield of a crop is the expression of combined effect of various yield components of the crop. All the yield components contributing to the grain yield were observed to have significant effect due to the mulching except the test weight, indicating that the weight of seed is a genetic trait and not environmentally controlled. The higher grain yield in the mulched treatment could be due more moisture conserved because of increase infiltration and better retention of moisture encouraging optimal transpiration nutrient uptake and increasing rate of photosynthesis, and also suffocate weed growth that facilitated a better crop growth and development. The results were in agreement with Sajid *et al.* (2013), who reported that application of organic mulches conserved moisture and increase the soil temperature and also control weed thereby, enhancing the yield in pea. The results were also in agreement with Teame *et al.* (2017), who reported higher yield in sesame due to organic mulching.

Effect of rice husk mulching on economics of pea cultivation

Assessment of treatments in terms of economic traits revealed that the cost of cultivation, gross return, net return and benefit cost (B:C) ratio differed significantly due to rice husk mulching in pea (Table 2). Among the different highest cost of cultivation (52560/ha) was observed with rice husk mulching of 60 q/ha (T_7). While lowest cost of cultivation (47935/ha) was recorded with the treatment without rice husk mulching (T_1). Gross return was significantly higher in the treatment with rice husk mulching of 60q/ha and followed by rice husk mulching of 50q/ha. While the lowest gross return was observed in the treatment with no rice husk mulching. The highest net return was observed with rice husk mulching of 60q/ha followed by rice husk mulching of 50q/ha. While lower net return was observed in the treatment with no mulching. Benefit cost ratio was highest with rice husk mulching of 60q/ha, followed by 50q/ha rice husk mulching. However, lowest benefit cost ratio (1.15) was recorded in treatment with no mulching. This might be due to the improvement in growth and yield attributes which ultimately increase the seed yield could be the reason for the enhanced economic returns in the above treatments. These results were in conformity with the findings of Daleshwar and Prasad (2017) in chickpea and Sanbagavalli *et al*. (2017).

Table 2. Effect of rice husk mulching on gross return, cost of cultivation, net return and B:C ratio of pea

Treatment	Gross return (/ha)	Cost of cultivation (/ha)	Net return (/ha)	B:C ratio
T_1	103000.00	47935.00	55065.00	1.15
T_2	117500.00	48885.00	68615.00	1.40
T_3	120533.00	49660.00	70873.33	1.43
T_4	126400.00	50385.00	76015.00	1.51
T_5	130933.00	51110.00	79823.00	1.56
T_6	141333.00	51835.00	89498.00	1.73
T_7	147433.00	52560.00	94873.00	1.81

T_1-Without rice husk mulching (control), T_2-10 q/ha of rice husk, T_3-20 q/ha of rice husk, T_4-30q/ha of rice husk, T_5-40 q/ha of rice husk, T_6-50 q/ha of rice husk, T_7-60 q/ha of rice husk

Conclusion

The result of this study revealed that significant differences due to rice husk mulching on germination percentage, yield and economics of pea. Observation of germination percentage showed a non-significant difference on the 5th days after sowing (DAS). However, on the 10th DAS, the germination percentage was significantly influenced by mulching. Among the treatments, rice husk mulching with 60q/ha recorded highest germination percentage (84.67 %). The length of pod, number of pods per plant and number of seeds per pod were significantly influenced by rice husk mulching. Significantly longer pod length (7.70 cm), more number of pods per plant (7.23) and more number of seeds per pods (6.33) were recorded with rice husk mulching of 60q/ha over the other treatments. However, test weight was found to be non-significant. Rice husk mulching with 60q/ha recorded maximum grain yield (14.74q/ha). As regard to the economics of the production of pea, the calculated gross return, net return and B:C ratio were generally more in 60q/ha rice husk mulching than other treatments. From the present investigation, it can be inferred that significantly higher grain yield (14.74q/ha) and monetary returns could be obtained by mulching with 60 q/ha rice husk in pea (Makhyatmubi).

Conflict of Interests

The authors declare that there are no conflicts of interest within them.

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