# EFFECT OF DIFFERENT RATES OF PRESSMUD ON PLANT GROWTH AND YIELD OF LENTIL IN CALCAREOUS SOIL

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## ABSTRACT

*A field trial was set up at Gomal University Research Farm, Dera Ismail Khan, Pakistan during 2007-2008 to asses the impact of pressmud on lentil yield and yield components. Four replicates of 8 treatments: control (no amendment), compound chemical fertilizer (NPK30:60:45 kg ha$^{-1}$) and pressmud applied at rate equivalent to 2, 4, 6, 10, 15 and 20 tons ha$^{-1}$ randomly allocated to field plots sown with leguminous crop lentil (Lens culinaris* L.*) The soil was calcareous with an alkaline pH of 8 and organic matter content of 8 g kg$^{-1}$. The data showed that lentil yield and other plant parameters were influenced by the different rates of pressmud. Among the 8 treatments, the highest number of branches plant$^{-1}$ (11.8–12.0), pods plant$^{-1}$ (44.0–45.2), grains pod$^{-1}$ (1.7–1.8), grain yield (768–799 kg ha$^{-1}$), dry matter yield (1168–1250 kg ha$^{-1}$) and root length (12.0–12.6 cm) of lentil were recorded in treatments receiving NPK or pressmud at the rate of 10 ton ha$^{-1}$.*

***Key Words*: Pressmud, Calcareous soil, Growth and yield of lentil.**

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## INTRODUCTION

There is a growing concern among the scientific community, environmentalists and policy makers about the safe disposal of the large amounts of organic wastes produced worldwide. Urbanization, industrialization, increasing food demand for rising human population, intensive use of relatively easily available and inexpensive chemical fertilizers and economic pressure are adding to the production and accumulation of large amounts of organic wastes. In Pakistan, some organic wastes such as farm waste, city waste (sewage and sludge), poultry litter and industrial wastes (food, sugar, cotton and rice industry) are recycled back by applying back to agricultural land but a significant amount of organic wastes is still disposed through other means such as burning which is associated with other environmental problems such as emission of particulates, heavy metals (e.g. Hg, Cd, and Pb), acidic gases (e.g. hydrogen chloride and sulfur dioxide) and dioxin to the atmosphere. Therefore recycling organic wastes by applying onto agricultural land seems to be the only best option in such scenario (Zaman *et al*., 2002; 2004). However, soil may not be regarded as a dumping place for organic wastes (Cameron *et al*., 1997).

Organic waste such as pressmud or filter cake is a byproduct of sugar factories and characterized as a soft, spongy, amorphous and dark brown to brownish material. Pressmud is reported to be a valuable resource of plant nutrients and may therefore affect physical, chemical and biological properties of a soil (Rangaraj *et al*., 2007; Kumar and Verma, 2002; Jamil *et al*., 2008; Muhammad and Khattak, 2009; Nehra and Hooda, 2002; Ramaswamy, 1999). Razzaq (2001) reported that continuous land application of sugarcane filter cake to agricultural crops for 5-6 years is likely to improve soil health by adding sulfur (S) and organic matter to soil. Therefore land application of pressmud is becoming a common farm practice in the sub-continent countries of Pakistan and India.

Legumes such as lentil (*Lens culinaris* L.) belongs to family leguminosae, is becoming an important crop in Pakistan, to meet the food and protein demand of our growing population. Lentil is usually a short duration crop and reported to improve soil fertility through symbiotic fixation of atmospheric di-nitrogen ($N_2$). In Pakistan, lentil is grown on an area of 39,000 hectares with total production of 21,000 tons (MINFAL, 2007). No information is available on the effect of different rates of pressmud on yield and quality of lentil crop grown on low fertility soils in D.I.Khan. Therefore the present field study was conducted to evaluate the impact of pressmud applied at different rates on crop growth, and yield of lentil on silty clay soil of Dera Ismail Khan, Pakistan.

## MATERIALS AND METHODS

### *Field Experiment*

A field trial to asses the different rates of pressmud on yield and growth parameters of lentil was conducted at Research Farm, Gomal University, Dera Ismail Khan, Pakistan during 2007-08. The experimental design consists of 8 treatments with 4 replications in RCBD. Thirty two field plots, each plot of 5.0 x 3.0 m$^2$

area were set up on a calcarious soil, Pressmud was applied @ 2, 4, 6, 10, 15, and 20 t $ha^{-1}$ before sowing the crop. Chemical fertilizer (N: P: K in the 30:60:45 kg $ha^{-1}$) was also applied to appropriate plots. Lentil seeds were sown in rows (with 10 cm space and row to row distance of30 cm) on 18th November, 2007. Lentil management practices include: normal irrigation, normal cultural practices such as (hoeing, weeding etc), and pesticide application during growing season. The crop was harvested on 28th March, 2008.

Agronomic parameters like germination count, branches $plant^{-1}$, plant height (cm), pods $plant^{-1}$, grains $pod^{-1}$, 1000-grains weight (g), grain yield $plant^{-1}$ (g), dry matter yield (g $m^{-2}$) and root length (cm) were recorded. Data were statistically analyzed (Steel and Torrie, 1980) to determine if the added treatments had any effect on the measured parameters. The 8 treatments used were:

C = Control (no N or organic waste)
F = fertilizer (only NPK) @ 30:60:45 kg $ha^{-1}$
P= Pressmud $P_1$ = 2 ton $ha^{-1}$, $P_2$ = 4 t $ha^{-1}$, $P_3$ = 6 t $ha^{-1}$, $P_4$ = 10 t $ha^{-1}$, $P_5$ = 15 t $ha^{-1}$, $P_6$ = 20 t $ha^{-1}$

## RESULTS AND DISCUSSION

### *Effect of Pressmud on Growth and Yield of Lentil*

### *Germination (Plants $m^{-2}$)*

The data of various measured parameters like germination, plant height, branches $plant^{-1}$, pods $plant^{-1}$, grains $pod^{-1}$, 1000 grain weight (g), grain yield (kg $ha^{-1}$), dry matter yield (kg $ha^{-1}$), root length (cm), and harvest index (%) are shown in Table I. The germination percentage showed that they were significantly influenced by various treatments of pressmud. Higher number of plants $m^{-2}$ were obtained from plots receiving chemical fertilizer (45.0), P3 (42.3), P4 (44.3), P5 (45.0), and P6 (46.0) compared to control (35.8), P1 (36.5), and P2 (38.0). Sangakkara *et al.* (2004) reported similar trend of higher germination percentage with the application of organic wastes.

**Table I** *Yield and yield attributing characters of lentil as affected by NPK and pressmud application*

| Treatments (t $ha^{-1}$) | Germination ($m^{-2}$) | Plant height (cm) | Branches $plant^{-1}$ | Pods $plant^{-1}$ | Grains $Pod^{-1}$ | 1000-grains weight (g) | Grain yield (kg $ha^{-1}$) | Dry matter yield (kg $ha^{-1}$) | Root length (cm) | H.I (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Control | 35.8 b | 19.9 e | 8.1 c | 36.9 c | 1.5 b | 14.5 d | 451.0 d | 785 c | 9.3 c* | 34.4 |
| NPK | 45.0 a | 24.5 a | 12.0 a | 45.2 a | 1.8 a | 15.8 ab | 799.0 a | 1250 a | 12.3 a | 39.0 |
| $P_1$ (2) | 36.5 b | 20.9 d | 8.2 c | 36.8 c | 1.5 b | 14.6 cd | 484.0 d | 838 bc | 9.5 c | 36.6 |
| $P_2$ (4) | 38.0 b | 21.1 d | 8.1 c | 38.3 bc | 1.5 b | 14.6 cd | 535.0 c | 918 b | 10.3b | 36.8 |
| $P_3$ (6) | 42.3 a | 22.6 c | 10.1 b | 40.0 b | 1.5 b | 15.4 abc | 648.0 b | 928 b | 10.4 b | 41.1 |
| $P_4$ (10) | 44.3 a | 24.4 ab | 11.9 a | 44.4 a | 1.7 a | 15.9 a | 768.0 a | 1173 a | 12.1 a | 39.6 |
| $P_5$ (15) | 45.0 a | 24.5 ab | 12.0 a | 44.1 a | 1.7 a | 16.2 a | 797.0 a | 1223 a | 12.6 a | 39.5 |
| $P_6$ (20) | 46.0 a | 23.9 b | 11.8 a | 44.0 a | 1.7 a | 15.0 bcd | 776.0 a | 1168 a | 12.0 a | 39.9 |
| $LSD_{0.05}$ | 3.8 | 0.6 | 0.8 | 2.2 | 0.1 | 0.9 | 46 | 109 | 0.6 | |

* Figures with similar letters are not significantly different from each other at 5% probability level.

### *Plant Height (cm)*

There were significant differences among various treatments regarding plant height. Highest plant height (24.5 cm) was recorded with chemical fertilizer followed by P4 (24.4 cm), and P5 (24.5 cm), while lowest plant height (19.9) was recorded from control. These results are in line with the work carried out by other researchers (Nehra and Hooda, 2002; Naik and Rao, 2004), who reported increased plant height in lentil crop due to pressmud application.

### *Branches $Plant^{-1}$*

The data on number of branches $plant^{-1}$ revealed that they were significantly influenced by various treatments of chemical fertilizer and pressmud. Maximum values were recorded in plots treated with fertilizer (12.03), P4 (11.9), P5 (12.0), and P6 (11.8), while lowest number of branches were recorded in control (8.1), P1 (8.2), and P2 (8.1), the results being consistent with Rai *et al.* (2004) who reported that organic wastes enhanced plant growth favorably.

### *Pods $Plant^{-1}$*

The data of the number of pods $plant^{-1}$ were also significantly affected by various treatments. Maximum number of pods $plant^{-1}$ were recorded in NPK (45.20), P4 (44.4), P5 (44.0), and P6 (44.0) treated plots, while control (36.9) and P1 (36.8) gave lowest number of pods $plant^{-1}$ (Mathan and Ramanthan, 1999).

### *Grains $Pod^{-1}$*

The data of the number of grains pod$^{-1}$ were significantly affected by various treatments. More grains pod$^{-1}$ (1.7 to 1.8) were recorded in NPK, P4, P5, and P6 treatment compared with 1.5 recorded in control, P1, P2, and P3 treatments. These results are in line with Jamil *et al.* (2008) who also reported more grains after application of pressmud.

***1000-Grains Weight (g)***

The 1000-grains weight significantly increased with application of various doses of pressmud and mineral fertilizer in comparison to control. Maximum 1000-grain weight of lentil was found in P4 (15.9 g) and P5 (16.2 g) followed by chemical fertilizer (15.8 g). Minimum 1000- grains weight (14.5g) was recorded in control. These results are in line with those of Al-Mustafa *et al.* (1995) and Oloya and Tagwira, (1996) who found enhanced grain weight with different doses of pressmud.

***Grain Yield (kg ha$^{-1}$)***

Mean values for grain yield revealed that NPK and different doses of pressmud significantly affected grain yield. Maximum grain yield was achieved from NPK (799 kg ha$^{-1}$), P4 (768 kg ha$^{-1}$), P5 (797 kg ha$^{-1}$), and P6 (776 kg ha$^{-1}$) treatment, while minimum grain yield was achieved from control (451 kg ha$^{-1}$) and P1 (484 kg ha$^{-1}$). These findings are in analogy with the results of Haq *et al.* (2001).

***Dry Matter Yield (kg ha$^{-1}$)***

Data on dry matter yield showed significant differences among various treatments. Maximum dry matter yield was recorded in plots treated with NPK (1250 kg ha$^{-1}$), P4 (1173 kg ha$^{-1}$), P5 (1223 kg ha$^{-1}$), and P6 (1168 kg ha$^{-1}$), while minimum dry matter was recorded in control (785 kg ha$^{-1}$). These results are in conformity with those of Raundal *et al.* (1999), who found significant increase in dry matter yield with application of macronutrients and organic wastes.

***Root Length (cm)***

Root length was significantly affected by NPK and various pressmud treatments. Mean values for root length revealed that NPK, P4, P5, and P6 produced the highest root length in the range of 12.0 to 12.6 cm, while control treatment produced lowest root length (9.3 cm). Sangakkara *et al.* (2004) communicated similar results, who reported that root length increased with chemical and organic fertilizers.

***Harvest Index (%)***

The data of harvest index of lentil was not significantly affected by either NPK or pressmud treatments. All the treatments displayed almost similar H.I in the range of 34.4 to 41.1 %. This trend is contrary to that observed by Jamil *et al.* (2008).

## CONCLUSION AND RECOMMENDATIONS

Our results showed that the application of NPK (30: 60: 45 kg ha$^{-1}$) and pressmud (10 ton ha$^{-1}$) enhanced lentil yield and growth parameters on a silty clay soil of Dera Ismail Khan. The study indicates that pressmud included both macro and micro nutrients, which increased yield and yield attributing characters of lentil. The application of pressmud at the rate of 10 t ha$^{-1}$ enhanced yield of lentil therefore may offer the best management option for promoting efficient nutrient cycling in agro-ecosystem.

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