EFFECTS OF MUDPRESS USED AS SOIL CONDITIONER AND ORGANIC FERTILIZER ON MUNGO GROWN ON MAASIN CLAY

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ABSTRACT

Mudpress application increased the pH and nutrient level of the soil. Moreover, it favored the growth and development of mungo. The number of days from seeding to flowering and maturity decreased but the leaf area and herbage weight increased with the use of mudpress. The number, length and weight of pods, weight of 100 seeds and grain yield likewise increased in plants applied with mudpress. Results strongly indicate that application of mudpress particularly at the rate of 60 tons/ha is significantly more effective in enhancing growth and development of mungo as well as in increasing its yield than inorganic fertilizer.

Increasing the level of mudpress application decreased the bulk density of the soil. The use of 60 tons/ha of the material resulted in the lowest bulk density value of 1.27 g/cc. The highest value of 1.61 g/cc was obtained from the soil treated with inorganic fertilizer.

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KEY WORDS: Mudpress. Maasin clay. Soil conditioner. Organic fertilizer. Bulk density. Mungo.

INTRODUCTION

The physical condition of the soil is one of the major factors that affect the performance of agricultural crops. Some crops may thrive on compact soils, but the result may not be as good as when they are grown on loose and well-aerated soils. Soil compaction badly affects microbial activity and impedes the penetration of plant roots.

One way of correcting this soil problem is through the use of synthetic soil conditioners. However, these materials are expensive and not easily available to farmers. For this reason, locally available materials that have potential for this purpose should be studied.

Mudpress, a by-product in the manufacture of sugar, may improve the structure of the soil due to its high organic matter content. Paul (1970 as cited by Prasad, 1976) pointed out that increase in crop yield after mudpress application may be due to improved soil conditions.

Mudpress contains 1.07-3.13% N, 1.34-6.3% P, 0.02-1.77 % K, 30-39% O.M. (Covar, 1970 as cited by Almodiente et al., 1973) and considerable amounts of Ca and Mg (Prasad, 1976), hence, it may be a good organic fertilizer particularly for mungo. It is also abundant locally. PCARRD (1983) reported that the quantity of mudpress in the country reached 460,000 million tons/year.

Previous researches conducted revealed that mudpress increased the yield of corn (Almodiente et al., 1973; Asio, 1984) and sugarcane (Prasad, 1976). It also enhanced the growth of sorghum (Sivalingan et al., 1973).

This study was conducted to evaluate the response of mungo to mudpress application and to compare the effects of inorganic fertilizer and varying levels of mudpress on the bulk density of the soil.

MATERIALS AND METHODS

Preparation of Soil Medium

Surface soil of Maasin clay (Ultisol) was collected at a depth of 25 cm from an area formerly planted to lowland rice in Barangay Gaas, Baybay, Leyte. The soil was air-dried and placed in polyethylene bags (45.72 x 40.60 cm) with perforations on the sides to allow drainage. Each bag contained 10 kg of air-dried soil. The soil surface was approximately 3.8 to 5.0 cm from the rim of the polybag.

Experimental Design and Layout

The experimental area was laid out in a completely randomized design (CRD) consisting of six treatments replicated four times. Each replication was composed of five plants (polybags) placed 50 cm apart in a greenhouse. The treatments were as follows:

T_0 = control (no fertilizer application)
T_1 = 15 tons mudpress/ha (75 gm/bag)
T_2 = 30 tons mudpress/ha (150 gm/bag)
T_3 = 45 tons mudpress/ha (225 gm/bag)
T_4 = 60 tons mudpress/ha (300 gm/bag)
T_5 = 45-45-45 kg/ha complete fertilizer (1.6 gm of 14-14-14 fertilizer/bag)

Soil Sampling and Analysis

Prior to mudpress incorporation and after harvesting the crop, soil samples were collected for initial and final analysis, respectively. Soil bulk density was determined using the paraffin clod method (Black, 1965). Samples were also sent to Cebu Soils District Laboratory, Cebu for organic matter, N, P, K and pH determination.

Mudpress and Fertilizer Application

The mudpress at the prescribed rate was mixed thoroughly with the soil before putting in polybags. For the inorganic fertilizer treatment, one half of the complete fertilizer (45-45-45) was applied at planting and the remaining half, 4 weeks after emergence.

Thinning and Care of the Plants

Five seeds of mungo (var. CES 55) were planted in each bag. Thinning was done 2 weeks after emergence leaving only one plant per bag. Azodrin was applied 12 days after emergence and Follidol at flowering and 10 days later to control insect pests. Watering was done whenever necessary using a sprinkler. Weeds in the polybags as well as on the ground near the experimental plants were removed.

RESULTS AND DISCUSSION

Bulk Density of Soil

One of the physical properties of the soil related to crop growth is bulk density. High bulk density indicates that the soil is compact causing poor aeration and inadequate drainage of the soil. This condition impedes root penetration, thereby causing detrimental effects to plants.

In this study, the bulk density of the soil was reduced by mudpress application (Table 1). The highest level of mudpress applied (60 tons/ha) resulted in the greatest reduction in bulk density from 1.71 to 1.27 g/cc. Aside from the effects of the plant roots on

Table 1. Initial and final bulk density values of Maasin clay as affected by application of inorganic fertilizer and different levels of mudpress

Treatment	Bulk Density (g/cc)	
	Initial	Final
T_0 – (control)	1.71	1.59
T_1 – (15 tons/ha mudpress)	1.71	1.52
T_2 – (30 tons/ha mudpress)	1.71	1.48
T_3 – (45 tons/ha mudpress)	1.71	1.41
T_4 – (60 tons/ha mudpress)	1.71	1.27
T_5 – (45-45-45 kg/ha inorganic fertilizer)	1.71	1.61

the soil, this condition could partly be attributed to the fact that mudpress contains considerable amounts of wax and fat (Barnes, 1974) which play an important role in soil aggregation (Foth and Turk, 1972). The addition of mudpress may also have further enhanced microbial activity. Foth and Turk (1972) asserted that fungal mycelia serve to bind soil particles together. In addition, various substances synthesized by microorganisms may also act as cementing agents of soil particles. On the other hand, the slight decrease in bulk density of soil treated with inorganic fertilizer and of the unfertilized soil could be attributed to the effects of the plant roots which might have caused aggregation. Kohnke (1968) observed that such aggregation is due to secretions of gelatinous organic compounds by plant roots which serve as cementing agents of soil particles.

pH, Organic Matter and NPK Content of the Soil

Table 2 presents the initial and final pH, organic matter, and N, P, K contents of the soil. Soil analysis revealed an increase in soil pH with the application of mudpress. The application of 60 tons/ha mudpress increased the pH from 4.5 to 5.0 while lower rates of mudpress application slightly changed soil pH. These results may be due to the Ca and Mg contents of mudpress (Prasad, 1976) which tend to increase soil pH. Application of inorganic fertilizer slightly increased soil pH whereas no change in pH was noted in the control.

Table 2. Initial and final pH values, organic matter, and N, P, K contents of Maasin clay applied with inorganic fertilizer and different levels of mudpress.

Treatment	pH	O.M. (%)	Avail. P (ppm)	Ext. K (ppm)	N (%)
			Initial Determination		
Composite sample	4.5	2.3	13	156	0.115
			Final Determination		
T_0 – (control)	4.5	2.1	11	128	0.100
T_1 – (15 tons/ha mudpress)	4.8	2.5	22	166	0.125
T_2 – (30 tons/ha mudpress)	4.8	2.5	33	166	0.125
T_3 – (45 tons/ha mudpress)	4.8	2.5	29	180	0.125
T_4 – (60 tons/ha mudpress)	5.0	2.4	38	176	0.120
T_5 – (45-45-45 kg/ha inorganic fertilizer)	4.7	2.3	11	172	0.115

In spite of the high organic matter content of mudpress, only a slight increment in the organic matter content was recorded in the mudpress-treated soil. This implies that organic matter decomposition in these treatments was probably enhanced by improved soil conditions.

The N, P and K contents of the soil increased with mudpress application. On the other hand, there was a decrease in P and increase in K contents of the soil applied with inorganic fertilizer. Probably, there was fixation of P from inorganic fertilizer since the soil had low pH. No difference was observed in the initial and final N contents of the soil treated with inorganic fertilizer. In the control plots, N, P and K contents decreased.

Mudpress increased the pH, organic matter, P and K contents of the soil to a greater extent than inorganic fertilizer (Table 3). In the control plot, a decrease in the organic matter, N, P and K contents was noted. In this treatment, the crop probably utilized the inherent soil nutrients since there was no soil amendment done. Results of the final soil analysis showed high amounts of N, P and K in soil treated with mudpress. This implies that application of this industrial waste in the soil may be beneficial to the succeeding crops.

Agronomic Characters

The plants applied with 60 tons/ha of mudpress significantly differed in number of days from seeding to flowering from the control plants and the plants which received 45-45-45 kg/ha of inorganic fertilizer (Table 3). The other treatments gave statistically similar values.

Application of mudpress probably increased the nutrient level particularly of phosphorus in the soil and improved soil structure such that flowering of mungo was enhanced. Brady (1974) reported that phosphorus application favors flowering.

The number of days from seeding to maturity did not vary among the four levels of mudpress used (Table 3). However, mudpress appears better than inorganic fertilizer in enhancing maturity of mungo.

No significant differences in plant height as influenced by the different fertilizer treatments were observed at harvest. However, plants treated with 60 tons of mudpress/ha developed the largest leaf area (243.12 cm^2) followed by those applied with 45 tons of mudpress/ha (217.69 cm^2). The control plants exhibited the smallest leaf area (129.45 cm^2).

Higher herbage weight was obtained with the application of 60 tons mudpress/ha than no fertilizer treatment or with inorganic fertilizer application (Table 3). Plants applied with any level of mudpress produced statistically similar herbage yield.

Results clearly indicate that mudpress application favored the growth and development of mungo. It shortened the time needed by the plant to flower and mature. Moreover, leaf area and herbage weight were increased by treatment with mudpress. This may be attributed to improvement of soil condition and structure as well as to higher nutrient level in the soil due to the

Table 3. Agronomic characters of mungo as affected by inorganic fertilizer and mudpress application.

Treatment	No. of Days from Seeding to		Leaf Area* (cm^2)	Plant Height (cm)	Herbage Weight (t/ha)
	Flowering	Maturity			
T_0 – (control)	32.25 a	59.50 a	129.45 d	72.94	5.54 c
T_1 – (15 tons/ha mudpress)	31.00 abc	56.50 c	147.94 d	79.27	6.71 ab
T_2 – (30 tons/ha mudpress)	30.25 bc	55.62 c	177.60 c	77.37	6.84 ab
T_3 – (45 tons/ha mudpress)	30.25 bc	55.50 c	217.69 b	75.67	6.92 ab
T_4 – (60 tons/ha mudpress)	30.00 c	55.12 c	243.12 a	74.57	7.17 a
T_5 – (45-45-45 kg/ha complete fertilizer)	31.50 ab	58.00 b	147.41 d	78.02	6.21 b
C. V. (%)	2.76	1.64	8.03	5.08	7.45

Within a column, treatment means followed by a common letter are not significantly different at 5% level, DMRT.

*Computed using a correction factor of 0.701 determined by the authors.

Table 4. The effects of inorganic fertilizer and mudpress application on the yield and yield components of mungo.

Treatment	No. of Pods per Plant	Length of Pods (cm)	Weight of Pods (gm)	No. of Seeds per Pod	Weight of 100 Seeds (gm)	Grain Yield (t/ha)
T_0 – (control)	22.80 c	8.79 b	17.77 c	10.57	5.21 d	0.78 c
T_1 – (15 tons/ha mudpress)	34.60 ab	9.24 ab	28.49 a	10.60	6.42 bc	1.30 ab
T_2 – (30 tons/ha mudpress)	34.85 ab	9.25 ab	28.58 a	10.38	6.81 ab	1.40 ab
T_3 – (45 tons/ha mudpress)	37.20 ab	9.50 a	29.42 a	10.32	6.99 a	1.44 ab
T_4 – (60 tons/ha mudpress)	37.80 a	9.50 a	29.62 a	10.87	7.08 a	1.46 a
T_5 – (45-45-45 kg/ha complete fertilizer)	30.50 b	8.87 b	22.76 b	10.18	6.09 c	1.20 b
C. V. (%)	12.69	3.95	11.75	4.23	4.27	11.35

Within a column, treatment means followed by a common letter are not significantly different at 5% level, DMRT.

application of mudpress particularly at high rates, i.e. 60 kg/ha.

Yield and Yield Components

The number of pods per plant as well as the length and weight of pods did not significantly differ among the four levels of mudpress used (Table 4). Plants treated with mudpress produced more, longer and heavier pods than those applied with inorganic fertilizer. Morever, plants in the different treatments produced statistically similar number of seeds per pod.

Statistical analysis showed no significant effects of mudpress application at 30, 45 and 60 tons/ha on weight of 100 seeds. Nevertheless, these levels of mudpress gave heavier weight of 100 seeds than inorganic fertilizer and the control.

Grain yield appears not to be affected by the level of mudpress applied (Table 4). However, application of 60 tons mudpress/ha resulted in significantly higher grain yield than inorganic fertilizer application. The unfertilized plots obtained the lowest grain yield.

Application of mudpress particularly at the rate of 60 tons/ha resulted in production of more, longer and heavier pods, heavier seeds and in higher grain yield. This could be attributed to the effect of mudpress on nutrient and organic matter level of the soil as well as on the physical condition of the soil. Upon decomposition of mudpress, nutrients particularly P are released in the process. Devlin (1977) claimed that P is a constituent of nucleic acids, phospholipids, and of coenzymes NAD and NADP. As a constituent of ATP, it greatly contributes to seed formation. Thus, the mudpress increases the level of nutrients and organic matter in the soil and consequently improves the soil condition. These conditions favor the production of seeds and pods and result in increased grain yield.

On the other hand, lower yields were obtained in plants applied with inorganic fertilizer probably because this fertilizer material provided less nutrients for growth and development of mungo than mudpress.

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