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Research Article

Responce Of Phosphorus Integrated With Farm Yard Manure And Gypsum ($Caso_4$) On Yield Of Cotton *(Gossypium Hirsutum L.)* Crop.

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ABSTRACT

The research trial was conducted in three different locations i.e location-I (Adaptive Research Farm Karor) as well as farmer's field, loccation-II (Mouza, Muhammad pur , Wesenday Wali Tehsil and District Muzaffar Garh) and location-III (Mouza Harplo, Rohillan wali, Tehsil and District Muzaffar Garh). during kharif-2014 to demonstrate and evaluate the effect of different doses of Phosphorus (P) with Farmyard manure and Gypsum on the growth and seed cotton yield. Three treatments i.e. T_1 (Recommended dose of Phosphorus i.e. 114 P_2O_5 kg ha^{-1}), T_2 (50% of recommended Phosphorus + 10 ton FYM ha^{-1}) and T_3 (50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha^{-1}) were treated. Treatment T_2 (50% of recommended Phosphorus + 10 ton FYM ha^{-1}) gave maximum seed cotton yield (1822-47kg ha^{-1}) followed by T_1 (Recommended dose of Phosphorus. 114 Kg P_2O_5 ha^{-1}) that gave seed cotton yield (1692.98 kg ha^{-1}). Whereas, statistically minimum seed cotton yield (1558.49 kg ha^{-1}) was observed in T_3 (50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit. H_2SO_4 ha^{-1}) at location-I Adaptive Research Farm Karor, while at farmer's field,location-II, maximum seed cotton yield (2243.89kg ha^{-1}) was obtained in T_2 (50% of recommended Phosphorus + 10 ton FYM ha^{-1}) followed by T_1 (Recommended dose of Phosphorus 114 Kg P_2O_5 ha^{-1}) and T_3 (50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit. H_2SO_4 ha^{-1}) respectively. Whereas, statistically minimum seed cotton yield (1944.24 kg ha^{-1}) was observed in T_3 ((50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit. H_2SO_4 ha^{-1}). Similar trend of results were found in location-III. Cotton variety MNH-886 was cultivated in all three locations.

Key words: Cotton *(Gossypium hirsutum L.)*, Phosphorus, Farmyard manure, Gypsum, H_2SO_4, Punjab. Pakistan.

Introduction

Cotton, *Gossypium hirsutum L.* (family Malvaceae) is one of the major cash crops of Pakistan and is also known as silver fiber (Gill and Dhawan, 2006).The cotton crop production accounts for 1.5 percent in GDP and 7.1 percent in agriculture value addition. During March –July 2014 -15, textile industry fetched foreign exchange of US$ 10.22 billion. During 2014-15, the cropped area of cotton stood at 2961 thousand hectares, showing an increase of 5.5 percent over last year's area of 2806 thousand hectares. Cotton production for the year 2014-15 stood at 13.983 million bales against 12.769 million bales last year showing an increase of 9.5 percent (Anonymous- 2015). It is a main earning source of foreign exchange and occupies the largest portion after wheat. The millions of farmers are dependent on this crop along the entire value chain from weaving

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to textile, clothing exports, good production and utilization in the country (Hashmi, 1994, Lohar, 2001, GOP, 2013).For reclamation of sodic and saline sodic soils, various amendments like gypsum, $CaCl_2$, HCl, H_2SO_4 and farmyard manure are required. These amendments either change insoluble soil calcium to soluble form or supply calcium directly, which replaces the absorbed sodium from sodic and saline-sodic soils. Previous work has shown that sulfuric acid proved to be more effective in reducing Exchangeable Sodium Percentage (ESP) of the soil than gypsum (Vadyanina & Roi, 1974). Water penetration into sodic soil was also improved with sulfuric acid treatment. One of the important factor constantly being overlooked was to record the changes in the Physical characteristics of soil after reclamation. In most soil of the Punjab (Pakistan), the major soluble anions are bicarbonates, sulfates and chlorides. A major amount of gypsum added to the soil is utilized in neutralizing or precipitating the soluble carbonates and bicarbonates. Since carbonates and bicarbonates in the soil are in the solution Phase, they freely react with added gypsum (Abrol *et al*., 1978). It was economically feasible to reclaim most alkali soils provided that effective drainage and adequate irrigation water is available. Simple leaching can reclaim saline soils whereas black alkali soils need proper amount of gypsum, sulfur, Iron sulfate and aluminum sulfate along with leaching. Bower *et al*. (1951) applied lime, sulfur, and gypsum alone and in combination with manure and found that infiltration was the greatest with (gypsum + manure) treatment and the highest decrease in ESP occurred in case of gypsum treated plots.

Decrease in PH was more in upper 12 inches soil. They observed that sulfuric acid was more effective in decreasing soil PH than gypsum and sulfur. Haq (1966) tried gypsum, H_2SO_4, press-mud, FYM etc. for reclaiming saline sodic soil. He observed comparable results in respect of reduction in PH, ECe and ESP with H_2SO_4 and gypsum treatments. Kausar and Muhammad (1972) reclaimed sodic soil by gypsum application followed by leaching in much shorter time as compared to biological methods. They also observed an increase in hydraulic conductivity, exchangeable and soluble Ca + Mg and decreased in exchangeable Na, + K, + ESP, free lime, PH, ECe and SAR with gypsum treatment. Muhammad and Khaliq (1975) reported that decrease in ECe, lime, PH and increase in hydraulic conductivity, soluble and exchangeable Ca and Mg was more with sulfur than with gypsum alone or in combination with FYM. Yahia *et al*. (1975) concluded that sulfuric acid was more effective than gypsum, especially for soil having higher ESP value. Sulfuric acid dissolved Ca CO_3, which in turn enhanced water penetration. Gupta and Bajpai (1977) observed that addition of gypsum, H_2SO_4 or $CaCl_2$ improved the Physical as well as chemical properties of saline-alkali soil under regular flushing. Ghafoor (1980) applied gypsum, sulfuric acid, HCl and HNO_3 in equivalent amounts to calcareous saline-sodic soil and found that all treatments increased the hydraulic conductivity except simple leaching. Gorbunov (1980) observed improvement of soil structure and increased water permeability.

According to Sharma *et al*. (1982), the soil PH, ECe $CaCO_3$, exchangeable Na^+ and dispersion ratio decreased considerably; whereas, exchangeable Ca^{2++} $Mg^{2++,}$ hydraulic conductivity, water infiltration and redistribution increased as a result of gypsum application. Field measurements suggested that

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gypsum did not affect the bulk density in the profile, but increased water penetration. Increased hydraulic conductivity (K), aggregate stability index (ASI) and air-filled porosity were obtained when samples collected from gypsum treated plots were tested in the laboratory (Sharma, 1971). Hydraulic conductivity and drainage porosity were the most important properties affecting sub-surface drainage under steady condition. Amendments are costly inputs and sometimes are not affordable by the poor farmers. Recently, demands have been emerging to divert the direction of research to reclaim the sodic soils with minimum inputs or at least in split doses in order to curtail the initial investment. Hussain *et al.* (2000) reported that splitting of gypsum into two equal doses (25% GR.) was very useful to reclaim the saline sodic soil, although the reclamation time was increased. The present studies were conducted not only to find the effectiveness of different amendments in amelioration of such soils but also to investigate the new basis for working out the quantities of reclaments like soluble carbonates + bicarbonates.

Materials And Methods:

Location

The experiments were conducted in three locations i.e location-I (Adaptive Research Farm Karor) Punjab, Pakistan as well as farmer's field, loccation-II (Mouza, Muhammad pur , Wesenday Wali Tehsil and District Muzaffar Garh) and location-III (Mouza Harplo, Rohillan wali, Tehsil and District Muzaffar Garh) during kharif-2014 were conducted during Kharif 2014, using cotton variety MNH-886 with seed rate of 25 kg ha^{-1} during the year 2014 to demonstrate and evaluate the effect of different doses of Phosphorus (P) with Farmyard manure and Gypsum on the growth and seed cotton yield . The fertilizers NPK was applied as per recommendation and standard agronomic practices were given at a proper time. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications.

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Treatments

Three treatments i.e. T_1 (Recommended dose of Phosphorus. 114 Kg P_2O_5 ha^{-1}), T_2 (50% of recommended Phosphorus + 10 ton FYM ha^{-1}) and T_3 (50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha^{-1}) were comprised**.**

Parameters

The following growth parameters include germination, plant height (cm), and yield parameters include the no. of bolls/plant, boll weight (gm) and yield kg/ha were recorded.

Methods

- **Germination**

  The germination percentage was calculated by following formula

  Germination (%) = Number of germinated seeds / Total seeds number × 100
- **Number of plants /m^2**

  Number of plants per square meter emerged were recorded daily.
- **Boll weight**

  Weight of five bolls (seed cotton + hulls) was taken from each replicate of all the treatments and then average was taken in grams.
- **Final plant height (cm)**

  Five plants were selected at random from each plot and were measured in centimeters with the help of measuring tape by placing it

along the axis of the plant and average was taken.

- **Seed cotton yield (kg ha^{-1})**

  The yield of seed cotton in kg ha^{-1} was calculated by taking picking from each plant and converting it on hectare basis.

Statistical Analysis

Year wise data was subjected to statistical analysis separately by using analysis of variance technique. The difference among treatment means was compared by using least significant difference test at 5% probability level (Steel *et al*., 1997).

Results And Discussion

Results

Germination / (52.25")

Data presented in (table I , II & III) showed non-significant differences were found among the treatments as regard plant population / (52.25") in three location at Adaptive Research farm Karor, layyah and farmer,s field . All the treatments have no impact on germination of cotton crop during Kharif-2014 in three locations.

Plant Height (cm)

Data presented in table 1 & III showed non significant differences among the treatments regarding plant height (cm) of cotton at Adaptive Research Farm. Data revealed in table-I that maximum plant height 176.6 cm was obtained in T_2, where 50% of recommended Phosphorus + 10 ton FYM ha^{-1} was applied which is statistically non significant to T1(175cm) & T3 (174.33 cm) where Recommended dose of Phosphorus i.e. 114 P_2O_5 kg ha^{-1} & 50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha^{-1} were applied respectively. The similar trend of results was observed in location : III as shown in table :III. Similarly in case of Locaton-II (Table-II) significant differences among the treatments regarding plant height (cm) was found.

No. of bolls plant^{-1}

It is evident from table-1 that maximum no. of bolls plant^{-1} 42.50 was found in T2 where 50% of recommended Phosphorus + 10 ton FYM ha-^{1} was applied which is statistically significant to T1 (38.83) & T3 (37.63) where Recommended dose of Phosphorus i.e. 114 P_2O_5 kg ha-^{1} & 50% of recommended Phosphorus + 0.5 ton Gypsum ha-^{1} + 69 lit H_2SO_4 ha-^{1} were applied respectively but the treatments T1 and T3 were non significant with each other. Similar trend of results was found in location – III as shown in table-III.In case of location-II treatment T2 and T1 were at par with each other and significant to treatment T3 as shown in table-II.

Average boll weight (gm)

Data presented in location I, II & III showed non-significant differences among the treatments regarding average boll weight (gm). The maximum average boll weight (gm) was in T2 where 50% of recommended Phosphorus + 10 ton FYM ha^{-1} was applied which is statistically non significant to T1 & T3 where recommended dose of Phosphorus i.e. 114 P_2O_5 kg ha^{-1} & 50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha^{-1} were applied respectively at all three locations as shown in table I, II & III.

Seed cotton yield (kg ha^{-1})

As it is clear from location -1 at adaptive Research Farm Karor, Layyah that significant difference was found among the treatments regarding seed cotton

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yield kg ha^{-1} . Maximum seed cotton yield kg ha^{-1} 1822-47was obtained from the plot T2 treated with 50% of recommended Phosphorus + 10 ton FYM ha^{-1} was applied which is statistically non significant to T1 (1692.98 kg ha^{-1} & significant T3 (1558.49 kg ha-^{1}) where recommended dose of Phosphorus i.e. 114 P_2O_5 kg ha^{-1} & 50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha-^{1} were applied respectively as shown in table I, The treatment T1 and T2 were at par with each other. Where as in case of location –II , maximum seed cotton yield 2243.89kg ha^{-1} was obtained from the plot T2 treated with 50% of recommended Phosphorus + 10 ton FYM ha^{-1} was applied which is statistically significant to T1 (1968.33 kg ha-^{1} & T3 (1944.24 kg ha^{-1}) where recommended dose of Phosphorus i.e. 114 P_2O_5 kg ha^{-1} & 50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha^{-1} were applied respectively as shown in table-II. The similar trend of results was found in location-III as shown in table-III. So it is concluded that maximum seed cotton yield kg ha^{-1} was obtained where 50% of recommended Phosphorus + 10 ton FYM ha^{-1} was applied.

Disscussion

The results can also be compared with those of Nziguheba *et al.*, 1998 reported that addition of organic materials causes mineralization of more recalcitrant fraction of P through increased microbial activity and resultant biochemical transformation. Whalen and Chang, 2001, reported that interactions with soil components to increase P uptake by plants are also important especially clay and lime contents. Gibali and Rahmatullah (1982) also concluded that addition of P in combination with manure resulted in higher concentration of P in plants. Similar results were also reported by Chaudhary *et al.*, (1998) about the maximum P uptake by the plants growing in soil treated with both organic and inorganic fertilizers. In general it was observed that high intensity of P (concentration in soil solution) was found with inorganic source DAP than the organic FYM. From the environmental point of view P from organic source is considered better but it alone cannot meet the crop requirements as has been observed in the present study. Increase in shoot dry matter was more than with FYM but combination of organic and inorganic sources proved best over the all treatments which is in accordance with the results reported by Kawabiah *et al.*, (2003). The positive influence of gypsum fertilization owing to be the results of improved nutritional environment in the rhizosphere as well as in the plant system which leads to translocation of N, P and S to reproductive parts which ultimately increased the concentration of these nutrients in kernel (Alcordo and Rechcigl 1993). So it is concluded that maximum seed cotton yield kg ha^{-1} was obtained where 50% of recommended Phosphorus + 10 ton FYM ha^{-1} was applied.

Conclusion

From the results of all three locations it is concluded that maximum seed cotton yield kg ha^{-1} was obtained where 50% of recommended Phosphorus + 10 ton FYM ha^{-1} was applied.

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Integrated Effect of chemicals and biochemical's fertilizers on growth and yield parameters of cotton cops

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Table: I- Integrated Effect of chemicals and biochemical's fertilizers on growth and yield parameters of cotton cops at Location:I. (*Average of three replication*)

Treatments	Germination/ (52.25")	Plant height (cm)	No. of bolls plant^{-1}	Boll weight (gm)	Seed Cotton yield (kg ha-^{1})
$T_{1=}$(Recommended dose of Phosphorus . 114 Kg P_2O_5 ha^{-1})	9.00 a	175 a	38.83 b	3.20 a	1692.98b
$T_{2=}$ (50% of recommended Phosphorus + 10 ton FYM ha^{-1})	9.66 a	176.60 a	42.50 a	3.46 a	1822-47a
$T_{3=}$ (50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha^{-1})	9.33 a	174.33 a	37.63 b	3.13 b	1558.49 ab

Means in the columns followed by different letters are significantly different at 5% level of probability, using LSD.

table: II=Integrated Effect of chemicals and biochemical's fertilizers on growth and yield parameters of cotton cops at Location:II. (*Average of three replication*).

Treatments	Germination/ (52.25")	Plant height (cm)	No. of bolls plant^{-1}	Boll weight (gm)	Seed Cotton yield (kg ha^{-1})
$T_{1=}$(Recommended dose of Phosphorus . 114 Kg P_2O_5 ha^{-1})	11.00 a	172.31 ab	37.74 a	3.28 a	1968.33 b
$T_{2=}$ (50% of recommended Phosphorus + 10 ton FYM ha^{-1})	11.33 a	176.55 a	39.47 a	3.40 a	2243.89a
$T_{3=}$ (50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha^{-1})	10.66 a	170.38 b	31.17 b	3.27 a	1944.24 b

Means in the columns followed by different letters are significantly different at 5% level of probability, using LSD.

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Table: III, Integrated Effect of chemicals and biochemical's fertilizers on growth and yield parameters of cotton cops at Location:III. (*Average of three replication*).

Treatments	Germination/ (52.25")	Plant height (cm)	No. of bolls plant^{-1}	Boll weight (gm)	Seed Cotton yield (kg ha^{-1})
$T_{1=}$(Recommended dose of Phosphorus . 114 Kg P_2O_5 ha^{-1})	9.33a	172.33a	36.20 b	3.85a	1748.52 ab
$T_{2=}$ (50% of recommended Phosphorus + 10 ton FYM ha^{-1})	8.66a	168.20a	40.57a	3.92a	2041.91a
$T_{3=}$ (50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha^{-1})	8.66a	162.34a	35.21 b	3.66a	1718.03 b

Means in the columns followed by different letters are significantly different at 5% level of probability, using LSD.

table:IV. Pool data of all tables of Location I,II,III.

Treatments	Germination/ (52.25")	Plant height (cm)	No. of bolls plant^{-1}	Boll weight (gm)	Seed Cotton yield (kg ha^{-1})
T_1(Recommended dose of Phosphorus . 114 Kg P_2O_5 ha^{-1})	9.77	173.21	37.59	3.44	1803.27
T_2 (50% of recommended Phosphorus + 10 ton FYM ha^{-1})	9.88	173.78	40.84	3.59	2036.09
T_3 (50% of recommended Phosphorus + 0.5 ton Gypsum ha^{-1} + 69 lit H_2SO_4 ha^{-1})	9.55	169.01	34.67	3.35	1740.25

Means in the columns followed by different letters are significantly different at 5% level of probability, using LSD.

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Gossypium hirsutum, also known as upland cotton or Mexican cotton, is the most widely planted species of cotton in the world. Globally, about 90% of all cotton production is of cultivars derived from this species. In the United States, the world's largest exporter of cotton, it constitutes approximately 95% of all cotton production. It is native to Mexico, the West Indies, northern South America, Central America and possibly tropical Florida. 1982). Cotton (Gossypium hirsutum L.) also takes up the majority of its K1 during the blooming and boll-filling. period (Bassett et al. 1970, Mullins and Burmester 1990).Â Integrating the effect K1 has on all of these physio-logical processes means that the K1 level can have profound effects on crop growth and development. One of the more visually obvious consequences on plant growth from insufficient levels of plant potassium is a reduction in plant stature (Cassman et al.Â Chapman FM, Mason JL (1969) Effect of phosphorus and potassium fertilizers on the agronomic characteristics of spring wheat and their interaction on grain yield. Can J Soil Sci 49: 343â€“347. Phosphorus Response of Chickpea and Evaluation of Phosphorus Availability in Indian Alfisols and Vertisols. In: Phosphorus Nutrition of Grain Legumes, Johansen, C., K.K. Lee and K.L. Sahrawat (Eds.). ICRISAT, India, pp: 33-41.Â Soil enzyme activity as affected by the integrated use of P sources with vermicompost and phosphobacteria in Cotton (Gossypium hirsutum)-Pulse (Vigna ungigulata) mix in an inceptisol. Proceedings of the 18th World Congress of Soil Science Held from Jul. 9-15, Pennsylvania, USA.Â Effect of phosphate-solubilizing bacteria and farmyard manure on the yield of blackgram (Phaseolus mungo). Indian J. Agric.Â Interactive effect of rhizotrophic microorganisms on yield and nutrient uptake of chickpea (Cicer arietinum L.). Eur. J. Agron., 19: 15-21.