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Original Research Article

INFLUENCE OF DIFFERENT INORGANIC PHOSPHATIC SOURCES AND ORGANIC MANURES ON FRACTIONS OF PHOSPHORUS IN SODIC SOIL

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Abstract: A field experiment was conducted in sodic soil to assess the effect of different sources of phosphorus and organics on fractions of phosphorus under maize. The treatments included here were Control (T_1), SSP alone (T_2), SSP + GM @ 10 t ha^{-1} (T_3), SSP + FYM @ 12.5 t ha^{-1} (T_4), SSP + VC @ 0.5 t ha^{-1} (T_5), DAP alone (T_6), DAP + GM @ 10 t ha^{-1} (T_7), DAP + FYM @ 12.5 t ha^{-1} (T_8) and DAP + VC @ 0.5 t ha^{-1} (T_9).The results of the experiment revealed that the application of SSP + FYM @ 12.5 t ha^{-1} (T_4) recorded higher release of P from its fractions such as Ca-P, Fe-P, Al-P, saloid bound P, reductant soluble P, Olsen's P. The mean values ranged from 664.86 to 643.21 kg ha^{-1} in Ca-P, 162.51 to 158.86 kg ha^{-1} in Fe-P, 200.34 to 181.39 kg ha^{-1} in Al-P, 250.96 to 246.89 kg ha^{-1} in saloid bound P, 179.00 to 176.21 kg ha^{-1} in reductant soluble P, and 23.15 to 9.93 kg ha^{-1} in Olsen's P over a period of time. The concentration of organic P was getting raised in all the treatments. The treatment with the application of SSP along with FYM (T_4) recorded a higher organic P concentration at all stages of crop growth with the mean values ranged from 465.08 to 468.25 kg ha^{-1}.

Key words: Olsen's P, Organic P, Reductant soluble P, FYM

Introduction:

Phosphorus is one of the limiting nutrients in salt-affected soils because of its high fixation and very low recovery of the applied phosphorus caused by the conversion into Ca-P, Na-P and further change of unextractable form. Regarding the P fertility status of saline and sodic soils, there is a need for identification of viable, cost-effective and efficient nutrient management technology. Considering the growing multiple demands of the fast increasing population and rapidly declining land: man ratio, it is imperative to utilize the salt-affected soils in the country for crop production and other uses. Keeping these points in mind, the present investigation was taken up to estimate the different fractions of P under the influence of different phosphatic sources incombination with oranic manures in sodic soil.

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Materials and Methods

A field experiment was conducted in sodic soil to assess the effect of different sources of phosphorus and organics on forms of phosphorus under maize. The textural class of the soil is clay loam. The pH and EC of the soil is 9.0 and 2.5 dSm^{-1} respectively. The fertility rating of soil available nitrogen and phosphorus is low (161 kg ha^{-1} and 8.01 kg ha^{-1} respectively). The potassium status of the soil is high (316 kg ha^{-1}). The treatments included here were Control, SSP alone, SSP + GM @ 10 t ha^{-1}, SSP + FYM @ 12.5 t ha^{-1}, SSP + VC @ 0.5 t ha^{-1}, DAP alone, DAP + GM @ 10 t ha^{-1}, DAP + FYM @ 12.5 t ha^{-1} and DAP + VC @ 0.5 t ha^{-1}. The recommended dose of P (RDP) for maize is 65 kg P_2O_5 ha^{-1}. The nitrogen and potassium were applied asper the blanket recommendations. The treatments were replicated thrice in a randomized block design with the plot size of 5x4m. The test crop of maize cv. Ganga was grown upto maturity and harvested. The soil phosphorus fractions were estimated by the method described by Peterson and Corey (1966).

Results and Discussion

The results of the experiment revealed that the application of SSP + FYM @ 12.5 t ha^{-1} (T_4) recorded higher release of P from its fractions such as Ca-P, Fe-P, Al-P, saloid bound P, reductant soluble P and Olsen's P. The mean values ranged from 664.86 to 643.21 kg ha^{-1} in Ca-P, 162.51 to 158.86 kg ha^{-1} in Fe-P, 200.34 to 181.39 kg ha^{-1} in Al-P, 250.96 to 246.89 kg ha^{-1} in saloid bound P, 179.00 to 176.21 kg ha^{-1} in reductant soluble P, and 23.15 to 9.93 kg ha^{-1} in Olsen's P over a period of time. A similar trend of result was also reported by Reddy *et al.* (1999). It might be due to the fact that the addition of manures could increase the soil test P (Vanlauwe *et al.*, 2000) and decrease P sorption in sodic soil.The decrease in the concentration of phosphorus fractions might also due to the presence of small amount of gypsum in SSP which reduces the availability of P due to its conversion into less soluble P compounds. The concentration of organic P raised with crop maturity in soil is due to the reason that the addition of inorganic P along with energy sources resulted in the buildup of organic P in soils. These findings are in line with the reports of Tomar (2000).

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Table 1. Effect of different inorganic P sources and organics on Olsen's - P and Ca -P (kg ha^{-1}) concentration at different stages of crop growth in sodic soil

Treatments	Olsen's P							Ca -P						
	Days interval													
	15	30	45	60	75	90	105	15	30	45	60	75	90	105
T_1 - Control	6.20	5.82	5.26	5.04	4.80	4.54	4.47	574.15	578.90	584.42	590.10	595.20	601.50	610.26
T_2 – SSP alone	17.24	14.31	12.25	11.66	10.39	9.72	9.35	603.00	606.21	611.14	618.13	629.24	631.16	632.24
T_3 – SSP + GM	20.91	17.25	14.60	12.21	11.43	10.47	9.85	661.25	656.24	654.19	651.00	648.24	646.13	641.00
T_4 – SSP + FYM	23.15	20.21	15.36	12.70	11.41	10.35	9.93	664.86	660.34	657.13	652.36	650.11	646.94	643.21
T_5 – SSP + VC	18.42	16.24	13.20	11.15	10.70	10.00	9.61	629.24	627.00	624.14	621.13	620.24	620.00	618.56
T_6 – DAP alone	12.45	10.21	10.13	9.27	8.74	8.40	8.12	542.94	545.14	547.13	548.24	550.13	551.16	552.24
T_7 – DAP + GM	14.25	12.31	10.85	10.12	9.73	9.11	8.27	581.26	579.14	576.00	574.13	570.33	568.26	565.16
T_8 – DAP + FYM	15.61	13.49	12.15	11.34	10.36	9.73	8.51	587.52	585.34	581.21	574.54	570.48	569.34	568.17
T_9 – DAP + VC	13.73	11.64	13.61	12.04	11.13	9.69	8.13	567.11	565.25	564.08	563.16	563.00	561.19	560.56

Table 2. Effect of different inorganic P sources and organics on Fe - P and Al -P (kg ha^{-1}) concentration at different stages of crop growth in sodic soil

Treatments	Fe- P							Al -P						
	Days interval													
	15	30	45	60	75	90	105	15	30	45	60	75	90	105
T_1	160.34	163.15	165.50	166.30	167.05	167.50	168.20	204.10	202.20	201.04	199.25	196.18	194.25	193.30
T_2	166.08	167.49	168.75	169.50	170.20	171.00	173.24	209.65	208.10	207.45	206.25	205.20	204.38	203.36
T_3	163.46	162.91	162.54	162.01	161.75	161.34	160.25	200.34	197.59	193.28	190.56	187.00	184.25	181.39
T_4	162.51	161.98	161.07	160.56	159.94	159.17	158.86	201.58	199.34	196.84	192.21	188.65	186.39	184.58
T_5	160.99	164.38	163.86	163.24	165.90	162.41	162.19	204.38	202.16	198.74	196.35	195.00	192.85	190.35
T_6	162.13	162.76	163.12	163.61	164.20	164.83	165.35	205.27	204.75	204.12	203.86	203.08	202.75	201.39
T_7	160.93	160.75	160.44	160.27	160.10	160.00	159.82	202.26	201.13	199.84	197.66	196.29	195.51	194.16
T_8	160.15	159.83	159.65	159.36	159.15	159.01	158.94	203.00	202.41	201.64	200.85	198.76	196.59	195.45
T_9	161.88	161.72	161.58	161.39	161.27	161.13	161.08	204.00	203.18	202.21	201.69	200.58	199.97	199.13

Table 3. Effect of different inorganic P sources and organics on Saloid bound - P and Reductant soluble -P (kg ha^{-1}) concentration at different stages of crop growth in sodic soil

Treatments	Saloid bound P							Reductant soluble -P						
	Days interval													
	15	30	45	60	75	90	105	15	30	45	60	75	90	105
T_1 - Control	231.25	230.14	229.13	228.56	227.97	227.16	226.54	170.56	170.42	170.40	170.35	170.35	170.33	170.31
T_2 – SSP alone	256.51	256.24	255.18	254.91	254.38	254.03	253.68	176.75	176.74	176.71	176.69	176.68	176.65	176.65
T_3 – SSP + GM	250.96	250.03	249.64	248.89	248.08	247.51	246.89	178.55	178.33	178.04	177.85	177.41	177.50	177.33
T_4 – SSP + FYM	251.84	251.12	250.56	249.80	249.13	248.87	248.36	179.00	178.68	178.35	178.04	177.65	177.56	176.21
T_5 – SSP + VC	252.15	251.63	250.92	250.14	249.86	249.59	249.29	177.85	177.60	177.38	177.17	176.81	176.54	176.77
T_6 – DAP alone	236.27	236.20	236.01	235.74	235.56	235.34	235.14	172.16	172.21	172.30	172.38	172.50	172.63	172.86
T_7 – DAP + GM	233.46	233.97	232.48	231.86	231.34	230.70	230.16	172.78	172.48	172.31	172.09	171.97	171.90	171.84
T_8 – DAP + FYM	234.28	232.90	233.12	232.54	231.67	231.05	230.55	173.05	172.95	172.86	172.70	172.58	172.25	172.08
T_9 – DAP + VC	235.11	234.65	234.03	233.58	233.00	232.50	232.08	172.64	172.53	172.41	172.32	172.21	172.13	172.01

Table 4. Effect of different inorganic P sources and organics on organic - P (kg ha^{-1}) concentration at different stages of crop growth in sodic soil

Treatments	Days intervals						
	15	30	45	60	75	90	105
T_1 - Control	448.14	441.30	438.46	434.19	417.10	408.35	405.00
T_2 – SSP alone	457.13	452.12	448.14	439.16	435.15	427.10	424.20
T_3 – SSP + GM	466.28	466.78	467.09	467.49	467.94	468.13	468.50
T_4 – SSP + FYM	465.08	465.54	465.81	466.23	466.70	467.36	468.25
T_5 – SSP + VC	461.56	461.93	462.11	462.44	462.89	463.02	463.26
T_6 – DAP alone	450.31	450.12	450.00	449.90	449.68	449.58	449.49
T_7 – DAP + GM	453.19	453.34	453.62	453.81	454.00	454.21	454.49
T_8 – DAP + FYM	452.56	452.61	452.80	452.97	453.34	453.34	453.65
T_9 – DAP + VC	451.59	451.70	451.88	452.04	452.09	452.17	452.18