EFFECT OF CELRICH ON GROWTH, YIELD AND ON CHEMICAL COMPOSITION OF SOYBEAN CROP GROWTH IN VERTISOL

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A field trial with three doses of celrich (urban compost) and two doses of recommended dose of chemical fertilizer and their combination were tried in randomized block design replicated four times at Research Farm, College of Agriculture, Indore in Kharif season of 1997. A combination of 100% RDF with 75% celrich application gave maximum root weight of soybean. Application of celrich did not increase the pods per plant, while soybean stover yield increased with application of celrich. The 100% celrich increased the soybean seed yield significantly. A combination of recommended dose of chemical fertilizer and 1.5 t ha^{-1} celrich application gave the maximum seed yield of soybean. The chemical composition of soybean stover and seed were affected with application of chemical fertilizer and celrich. The integrated use of chemical fertilizer with celrich increased the growth, yield and productivity of soybean crop.

Material and Methods

A field experiment in randomized block design with 12 treatments replicated four times was conducted in the Kharif season of 1997 at College of Agriculture Research Farm, Indore. The experimental soil was medium black having (sand 12.56%, silt 34.04%, clay 53.04%, pH 7.8, organic carbon 0.28%, available N 760 kg ha^{-1}, P_2O_5 12.31 kg ha^{-1} and K_2O 518.20 kg ha^{-1}).

The treatment details are given below (Table 1). Sowing of soybean (variety JS-335) seed @ 25-30 q ha^{-1} were done in the plots. The row to row distance was maintained 30 cm and plant to plant was 45 cm. The soil and plant samples were collected for recording of analytical data and chemical analysis. The nitrogen, phosphorus, potassium, calcium, magnesium and sulphur were analysed in plants and seed as per standard procedure described by Piper (1950).

Table 1 Details of treatment

F_0	=	Control (No chemical fertilizer and no celrich)
F_1	=	Only recommended dose of chemical fertilizer (i.e. 20kgN+ 60 kg P_2O_5 ha^{-1})
F_2	=	20 kg N + 60 kg P_2O_5 ha^{-1} + 2 tonne celrich ha^{-1}
F_3	=	20 kg N + 60 kg P_2O_5 ha^{-1} + 1.5 tonne celrich ha^{-1}
F_4	=	20 kg N + 60 kg P_2O_5 ha^{-1} + 1 tonne celrich ha^{-1}
F_5	=	10 kg N + 30 kg P_2O_5 ha^{-1} + 2 tonne celrich ha^{-1}
F_6	=	10 kg N + 30 kg P_2O_5 ha^{-1} + 1.5 tonne celrich ha^{-1}
F_7	=	10 kg N + 30 kg P_2O_5 ha^{-1} + 1 tonne celrich ha^{-1}
F_8	=	Celrich alone 2 tonne ha^{-1}
F_9	=	Celrich alone 1.5 tonne ha^{-1}
F_{10}	=	Celrich alone 1 tonne ha^{-1}
F_{11}	=	Celrich 2 tonne ha^{-1} + bio-fertilizer (Rhizobium 15 g/kgseed + PSB 30 g/kg, Azotobactor 5 g/kg of seed)

The data on growth, yield attributes and seed yield and straw yield were collected and analysed statistically. The results of chemical analysis celrich are given in the table given below:

A. Chemical composition of celrich

pH	-	7.5
Organic carbon	-	1.8%
Nitrogen	-	1.75%
Phosphorus	-	1.25%
Potassium	-	1.20%
Calcium	-	0.52%
Magnesium	-	0.74%
Sulphur	-	0.55%

B. Biological properties of celrich

1. Total bacterial count/g 10^{10}
2. Actionomyces/g 10^{10}
3. Fungi/g 10^6
4. Azotobactor 10^6
5. Rhizobium bacteria 10^4
6. Phosphate solubilizing bacteria 10^6
7. Nitrobacter 10^2

The chemical fertilizer, bio-fertilizer and celrich was applied in soil as per the farmers practice.

Results and Discussion

Dry weight of root and shoot Data on dry weight of roots of soybean at different stages and dry weight of shoot are presented in Fig.1. There was an increase in the weight of root till 75 days. The sharp increase in dry weight was observed from 30 to 60 DAS stage, which correspond to grand growth period. Thereafter a short decrease from 75 DAS onwards in root weight till 90 DAS stage was observed. A combination of 100% chemical fertilizer and 75% celrich application showed maximum root weight. Treated plot showed more dry weight of root over control. Raheja *et al*. (1971) in a field trial observed that application of organics significantly showed soil productivity build up. The build up of

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productivity is due to continuous application of organics. The better growth of roots of soybean in treated plots is due to the increased productivity (Singh and Shrivastava, 1971) of soil and improvement in physical condition of soil due to use of urban compost (Stevensons and Schnitzer, 1982). Data on dry weight of plant at different stages were recorded and presented in Fig.2. The accumulation of dry matter was observed till 75 DAS stage in all the treatments and thereafter the dry matter recorded a decrease may be due to falling of leaves from the soybean plants. A sharp increase in dry weight from 45 to 75 days was observed in all the treatments. The maximum dry matter was observed in treatments receiving 100% chemical fertilizer and 75% celrich. The least dry matter was observed in control at all the stages. Bangoo and Albrtton (1972) reported that soybean growth and yield showed positive correlation with nitrogen and potassium fertilization. The increased growth of soybean may be due to optimum nutrient supply and better soil condition for growth of root and shoot of soybean crop (Rehman and Haque, 1981 and Billore *et al*., 1994).

Number of pods

The data on number of pods per plant of soybean crop are presented in Table 2 indicated that application of increasing doses of chemical fertilizer increased the number of pods. The significant increase in number of pods observed with application of 100% chemical fertilizer. The application of celrich alone or with chemical fertilizer did not showed any effect on mean number of pods.

Table 2 Effect of chemical fertilizer and celrich application on number of pods per plant

Fertilizer	Celrich			Fertilizer mean
	50%	75%	100%	
0%	10.60	10.55	10.00	10.38
50%	10.40	11.25	10.20	10.61
100%	10.85	13.55	12.15	12.18
Mean for celrich	10.61	11.78	10.78	
			SE(m) +	CD 0.05%
Fertilizer			0.40	1.17
Celrich			0.40	NS
Interaction F x Cel.			0.69	NS

Stover and seed yield

Data on stover and seed yield (q ha^{-1}) of soybean were presented in Table 3 and 4 indicated that soybean stover yield significantly increased with celrich application. Application of 100% chemical fertilizer + 75% celrich combination gave the maximum stover yield (29.36 q ha^{-1}) while the minimum was with 50% celrich (20.20 q ha^{-1}) application. The soybean seed yield increased significantly with all the treatments over control except that Cel_{100} + Bio combination. The application of 100% celrich increased significantly the seed yield (25.92 q ha^{-1}). A combination of recommended dose of chemical fertilizer and 1.5 t ha^{-1} celrich application gave the maximum seed yield of soybean. Application of 50% celrich showed lowest yield (22.07 q ha^{-1}). Gattani *et al*. (1976) reported that continuous use of FYM helped in maintaining and improving physical properties of soil and maintain the organic carbon content in soil. Stevensons and Schnitzer (1982) stated that soil organic matter influence plant growth as well improves the fertility of soil. This causes the optimum supply of nutrients to crop. The improvement in biological condition of soil causes increase in stover and seed yield of soybean due to the ameliorating effect on soil due to application of celrich along with chemical fertilizer. Thus it can be concluded that integrated use of celrich increase the growth and seed yield of soybean.

Chemical composition

Data on chemical composition of stover and seed are presented in Table 5, indicated that nitrogen content in soybean plant increased significantly with application of treatments over control. The nitrogen content was maximum with application of recommended dose of chemical fertilizer and 1.5 t ha^{-1} celrich application. Nitrogen content in stover at harvest did not change due to application of treatments. Phosphorus content in stover increased significantly with all the treatments over control. The maximum phosphorus content was observed in the treatment where the recommended dose of chemical fertilizer + 100% celrich was applied. The phosphorus content of seed increased significantly with application of treatments over control and it was maximum with recommended dose of chemical fertilizer and 75% celrich application. The potassium content in soybean plant and seed increased significantly with application of treatments over control. The application of chemical fertilizer increased the potassium content in soybean seed, while application of celrich did not show any significant effect on potassium content in seed. Bangoo and Albrtton (1972) in a study observed that soybean yields showed a positive correlation with nitrogen and potassium application. Agrawal and Narang (1973), Hatam (1977), Nimje and Jagdish (1988) also reported similar findings. Thus from the present study it is concluded that the integrated use of celrich with chemical fertilizer increased the growth, yield attributes, seed yield and affect the chemical composition of soybean seed.

Table 3 Effect of chemical fertilizer and celrich application on stover yield of soybean (q ha^{-1})

Fertilizer	Celrich			Fertilizer mean
	50%	**75%**	**100%**	
0%	22.18	20.20	22.80	21.72
50%	19.88	24.57	19.88	21.45
100%	18.53	29.36	23.74	23.28
Mean for celrich	20.20	24.71	22.14	

	SE(m) +	CD 0.05%
Fertilizer	0.91	NS
Celrich	0.91	2.64
Interaction F x Cel.	1.59	4.58

Table 4 Effect of chemical fertilizer and celrich application on seed yield of soybean

Fertilizer	Celrich			Fertilizer mean
	50%	**75%**	**100%**	
0%	22.18	20.20	22.80	21.72
50%	19.88	24.57	19.88	21.45
100%	18.53	29.36	23.74	23.28
Mean for celrich	20.20	24.71	22.14	

	SE(m) +	CD 0.05%
Fertilizer	0.91	NS
Celrich	0.91	2.64
Interaction F x Cel.	1.59	4.58

Table 5 Effect of chemical fertilizer, celrich and their combination on chemical composition of soybean

SN	Treatment	Stover			Seed		
		N%	**P%**	**K%**	**N%**	**P%**	**K%**
1	Control	2.78	0.08	1.12	5.04	0.41	2.02
2	RF (Recommended fertilizer)	3.29	0.15	1.47	6.00	0.56	2.33
3	RF + Cel_{100}	3.30	0.18	1.51	6.09	0.57	2.38
4	RF + Cel_{75}	3.32	0.16	1.54	6.18	0.58	2.40
5	RF + Cel_{50}	3.13	0.14	1.49	5.58	0.55	2.36
6	RF_{50} + Cel_{100}	3.10	0.13	1.34	5.30	0.48	2.31
7	RF_{50} + Cel_{75}	3.24	0.13	1.44	5.72	0.55	2.35
8	RF_{50} + Cel_{50}	3.12	0.11	1.44	5.48	0.52	2.33
9	Cel_{100}	3.10	0.14	1.36	5.37	0.49	2.30
10	Cel_{75}	3.11	0.12	1.37	5.46	0.51	2.32
11	Cel_{50}	3.09	0.14	1.29	5.27	0.45	2.26
12	Cel_{100} + Bio-fertilizer	3.07	0.12	1.26	5.22	0.45	2.23
	SEm +	0.05	0.01	0.02	0.09	0.01	0.02
	CD 0.05%	0.15	0.03	0.04	0.26	0.04	0.06

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