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RESEARCH ARTICLE

APPLICATION OF CALCIUM SULPHATE (GYPSUM) TO STUDY ITS INFLUENCE ON SOIL CHEMICAL PROPERTIES IN *OCIMUM BASILICUM* L.*CV.*CITRAL.

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ABSTRACT

A field experiment was conducted on *Ocimum basilicum* L.*cv.* Citral, which was treated with 1 ton /ha Calcium sulphate ($Caso_4 2H_2O$), to study its impacts on soil chemical properties like P^H, EC, Calcium, Magnesium, Carbonates and Bi-carbonates and Sulphates. The field was designed as RCBD with four replications. Observations were recorded for 15, 45, 75,105 days after planting. The results indicated that after 105 days after planting, Bicarbonates, Calcium, Magnesium, Chlorides and Sulfates content of the soil water increased due to gypsum application. No changes were seen in case of P^H.

INTRODUCTION

A good soil is a valuable asset for the nation. Soil consists of many minerals which are useful for the plant growth. Soils supply plants with mineral nutrients held in place by the clay and humus content of the soil. For optimum plant growth, the generalized content of soil components by volume should be roughly 50% solids (45% mineral and 5% organic matter), and remaining 50% of which half is occupied by water and half by gas. Soil P^H strongly affects the availability of nutrients. Poor irrigation techniques also affect the quality of soil. The best quality of soil provides water and nutrients for the growth of plants. The formation of one inch of fertile topsoil takes about 500 to 1000 years.

Typical soil that is suitable for agriculture contains 5% Organic matter and 95% Inorganic matter. Now-a-days in order to fulfill the needs of the growing population many persistent fertilizers are added to the soil for better yield this is slowly degrading the soil structure and functions. Many experiments were conducted to improve the plant yields upon application of fertilizers, out of which Gypsum is quite studied because it has many positive impacts on the soil improvement. Gypsum application can improve compact soil, decreases bulk density of soil, helps plant to absorb nutrients, decreases water logging and decreases soil P^H. Greater effectiveness of gypsum may be due to its higher solubility and the fact that it increases Ca concentrations without increasing P^H.

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MATERIALS AND METHODS

The Present study was conducted to identify the impacts on soil chemical properties in *Ocimum basilicum* L. *cv*. Citral which was treated with 1 ton/ha gypsum. This is an extension research work done along with another experiment. This experiment was carried out at CIMAP, Hyderabad. Fully grown seedlings of size 4-6" were planted in poly bags as per the lay out plan. Crops were regularly maintained and after 10 days of planting Gypsum were applied to the field. We have designed different treatments like Control, Incorporation, Broadcasting, Spots and Lines. Observations are recorded at regular intervals like 15, 45, 75,105 days after planting. Soil samples were collected from the respective fields or plots in a ploythene covers after measuring 20 gms with the help of electronic balance. 20gms of the given soil sample taken into a 100 ml clean glass beaker, added 40ml of distilled water 1:2 ratio measured in measuring cylinder, stirred well with a glass rod and allowed to settle for some time. Standard analytical procedures were followed to analyze P^H, EC, Carbonates, Bicarbonates, Chlorides, Calcium, Magnesium and Sulphates. Statistical analysis have been carried out and the results are presented and discussed at 5 % probability level uniformly. The non significant results are denoted as N.S.

Different methods of gypsum applications

S.No	Days after planting	Code
1	15	Stage I
2	45	Stage II
3	75	Stage III
4	105	Stage IV

S.No	Treatment	Details of treatment
1.	T1	Control
2.	T2	Incorporation
3.	T3	Broadcasting
4.	T4	Lines applications
5.	T5	Spots

Fig. 1. *Ocimum basilicum* L. *cv*. Citral

RESULTS AND DISCUSSION

P^H of the soil

The results pertaining to the soil pH as influenced by different methods during the experimental period is presented in Table 1.

Table 1. Influence of different methods of gypsum on the soil p^H at different stages

Treatment	Days after planting			
	Stage I	Stage II	Stage III	Stage IV
Control	7.83	7.68	7.87	7.7
Incorporation	7.63	7.44	7.6	7.07
Broadcasting	7.7	7.68	7.7	7.53
Lines	7.73	7.20	7.66	7.43
Spots	7.6	7.53	7.16	7.4
F'- Test	NS	NS	NS	NS
C.D.(P=0.05)	0.98	0.93	0.98	0.95
C.V.%	7.84	7.61	7.93	7.86

From the above data we can observe that there is no consistency in P^H readings it does not followed a particular pattern but still the P^H is still in neutral ranging from Min:7.61 to Max:7.86.Application of gypsum did not influenced the soil P^H.

EC of the soil

The results pertaining to the soil EC as influenced by different methods during the experimental period is presented in Table 2.

Table 2. Influence of different methods of gypsum on the soil EC (ds/m) at different stages

Treatment	Days after planting			
	Stage I	Stage II	Stage III	Stage IV
Control	0.58	0.20	0.28	0.22
Incorporation	0.36	0.25	0.32	0.21
Broadcasting	0.35	0.21	0.20	0.20
Lines	0.31	0.19	0.25	0.23
Spots	0.29	0.30	0.19	0.24
F'- Test	*	*	*	*
C.D.(P=0.05)	0.04	0.02	0.03	0.02
C.V.%	6.71	6.45	7.62	7.85

High sodium ions in water affect the permeability of soil and cause infiltration problems. Observations recorded for soil EC reveals there was a constant increase in Soil electrical conductivity in from Stage-1 to Stage-IV. The readings ranging from 6.71 to 7.85 still the soil is normal no risk of salinity seen during the experiment. It may be because of the high annual precipitation of the experimental area.

Carbonates and Bicarbonates

The results pertaining to the soil carbonates and bicarbonates as influenced by different methods during the experimental period are presented in Table-3.

Table 3. Influence of different methods of gypsum on the Carbonates and Bicarbonates (meq/lt) at different stages

Treatment	Days after planting			
	Stage I	Stage II	Stage III	Stage IV
Control	0.67	0.33	0.27	0.27
Incorporation	0.87	0.87	0.6	0.33
Broadcasting	0.67	0.73	0.33	0.4
Lines	0.67	0.47	0.53	0.47
Spots	0.87	0.87	0.53	0.27
F'- Test	*	*	*	*
C.D.(P=0.05)	0.08	0.08	0.06	0.06
C.V.%	6.79	7.61	9.15	11.34

Large amount of carbonates and bi-carbonates ions in irrigation water will precipitate calcium and ions as Calcium carbonate and calcium bi-carbonate. When the high bicarbonate irrigation water reaches the soil, the calcium can be removed from the soil particle. Sodium can then take the calcium's place at a rate of two sodium ions to each calcium ion. Hence soil becomes sodium dominant. Calcium is preferred over sodium on a soil particles exchange site, and will displace sodium if calcium is available in sufficient amounts in the soil. The sodium then becomes soluble and eventually leaches from the root zone. As per the observations noticed in different stages I to IV there was an increase in carbonates and bicarbonates noticed which shows that gypsum at constant 1 ton/ha does shown significance.

Chlorides

The results pertaining to the soil chlorides as influenced by different methods during the experimental period are presented in Table-4. Chloride is a micro-nutrient essential for Plant development. Chlorides exist in aqueous solution as a monovalent anion and its salts are readily soluble. It is not

adsorbed by organic matter or clay in moist soils, and hence it is mobile in the soil and readily leached from the soil because of heavy rainfall and over irrigated. From the above readings Chlorides content in soil in Stage II and III decreased this may because of washing away by the water and in Stage IV the chloride content seen to be increased. It also observed that plants are not affected with diseases.

Table 4. Influence of different methods of gypsum on the Chlorides (meq/lt) at different stages

Treatment	Days after planting			
	Stage I	Stage II	Stage III	Stage IV
Control	7.47	8.4	8.53	7.87
Incorporation	10.13	11.06	9.07	8.53
Broadcasting	8.93	11.6	10.8	10.53
Lines	9.73	10.4	9.73	9.2
Spots	8.93	10.8	10.53	9.87
F'- Test	*	*	*	*
C.D.(P=0.05)	1.25	1.42	1.32	1.27
C.V.%	8.50	8.38	8.34	8.52

Calcium and Magnesium

The results pertaining to the soil calcium and magnesium as influenced by different methods during the experimental period are presented in Table-5.

Table 5. Influence of different methods of gypsum on the Calcium and magnesium (meq/lt) at different stages

Treatment	Days after planting			
	Stage I	Stage II	Stage III	Stage IV
Control	9.6	7.4	7.07	7
Incorporation	8.87	8.53	8.73	8.07
Broadcasting	7.73	7.53	7.73	7.87
Lines	8.27	7.93	7.47	7.6
Spots	8.07	7.73	7.8	6.93
F'- Test	*	*	*	*
C.D.(P=0.05)	1.01	0.99	0.96	1.00
C.V.%	7.29	7.83	7.62	8.19

Acidic soils increase the tendency of magnesium to leach, because they have less exchangeable sites (lower CEC). In low-pH soils, the solubility of magnesium decreases and it becomes less available. The readings recorded at regular intervals reveals that there was an increase in magnesium and calcium content observed in different treatments. This helps to reduce soil salinity and increase plant yield. As magnesium deficiency leads to reduce in plant yield and high susceptible to diseases.

Sulphates

The results pertaining to the soil sulphates as influenced by different methods during the experimental period are presented in Table-6. Gypsum contains sulphur content of 15-18%.Soluble sulphates (SO^{4-}) accumulate in the plow layer because they are leached into the B horizon of soil. Much of the sulphates come from past fertilizers which are available in the soil layers. Deficiency of sulphates results in delayed in the maturity, gowth rate is retarded and plant height will be affected. But as per the observations what we have taken their was a significant influence shown on morphological characteristics like plant height, weight, number of leaves etc.

Table 6. Influence of different methods of gypsum on the Sulphates (meq/lt) at different stages

Treatment	Days after planting			
	Stage I	Stage II	Stage III	Stage IV
Control	8.89	6.81	6.53	6.48
Incorporation	8.20	7.89	8.07	7.49
Broadcasting	7	6.83	7.04	7.38
Lines	7.59	7.24	6.81	7.09
Spots	7.47	7.1	7.20	6.43
F'- Test	*	*	NS	*
C.D.(P=0.05)	0.92	0.90	0.87	0.93
C.V.%	7.22	7.77	7.53	8.25

From the data it is clear that gypsum application increased sulphates during different treatments the values ranging from 7.22 to 8.25.

Conclusion

From the above experiment we notice that soil p^H was not influenced it remained neutral before and after application of gypsum. The Carbonates, Bicarbonates, Calcium, Magnesium, Chlorides and Sulphates content of the soil water increased due to gypsum application. We can also observe that the values are following a consistent pattern from Stages I-IV and maximum values are noticed in Stage-IV in all the aspects of experiment. Hence, this experiment suggests that gypsum application upto 1 ton/ha for different methods of treatments is effective after 105 days after planting of *Ocimum basilicum* L. cv. Citral.

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