Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP2: 80-82

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National Conference on Conservation Agriculture
(ITM University, Gwalior on 22-23 February, 2018)

Effect of different levels and sources of phosphorous on biochemical changes of wheat (*Triticum aestivum* L.) under sodic soil

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Abstract
The present investigation entitled "Effect of different levels and sources of phosphorous on biochemical changes of wheat (*Triticum aestivum* L.) under sodic soil" was carried out at the Main Experimental Station (MES), Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) during *rabi* season of 2015-16. The experiment was laid down in randomized block design with three replications on wheat variety NW 1014 and pH of the soil is 9.4. Seven treatments were given and are comprised of T_1: Control, T_2: 60 kg /ha through SSP, T_3: 60 Kg Phosphorus /ha. through DAP, T_4: 80 Kg Phosphorus /ha. through SSP, T_5:80 Kg Phosphorus /ha. Through DAP, T_6:100 Kg phosphorus/ha. through SSP, T_7:100 Kg Phosphorus /ha. through DAP. Observations were recorded on chlorophyll, carbohydrate and protein content in leaves at 30, 60, 90 DAS.. All the levels and sources of phosphorus positively influenced biochemical changes positively however, the effect of T_4: 80 Kg Phosphorus /ha. Through DAP was found most effective and significantly increased chlorophyll, carbohydrate and protein content in leaves of wheat.

Keywords: Wheat, Sodic soil, Carbohydrate, Chlorophyll, Protein.

Introduction
Wheat (*Triticum aestivum* L.) is the important crop of India. It is consists second position in both area and production after rice in India as well as world after china. The Northern and Western part of India has maximum area and production under wheat cultivation. The record production in the country during last few years has enabled India to attain the position of being second largest producer of wheat in the world.

Sodic soil are widespread in the world and in India. It occurs mainly in Indo-Gangetic alluvial plains, where it is estimated to cover about 2.8 mha. In India, salt affected soils are spread 7.0 mha of which, 1.29 exists in U. P. alone (Abrol and Bhumbla 1971) [1]. However, information on salt affected area in India indicates for 13.0 mha (Yadav and Gupta, 1984). Salt affected soils contain excessive concentration of chloride and sulphate of sodium, calcium and magnesium (Saline soil) or excess of exchangeable sodium (alkaline or sodic soil) along with carbonate and bicarbonate. These affected soils are extensively distributed in arid and semi arid parts of Haryana, Punjab, Uttar Pradesh, Rajasthan, Gujrat, and Maharastra. The soil affected soil in U. P. are spread over several districts including Sultanpur, Raibarreilly, Azamgarh, Etawah, Pratapgarh, Ballia, Mau, Mainpuri, Hardoi, Kanpur, Faizabad, Jaunpur and Fatehpur (Singh and Tyagi 1980) [6].

Phosphorus is critical in the metabolism of plant, playing a role in cellular energy transfer, respiration and photosynthesis. It is also a structural component of the nucleic acid of gens and chromosome it works as many coenzymes, phosphoproteins and phospholipids, early season limitation in phosphorus availability can result in restriction in crop growth, from which the plant will not recover even when phosphorus supply of is increased to adequate level. An adequate supply of phosphorus is essential from the earliest stage of plant growth (Betanrd, *et al.* 2003). Beside many other factor, fertilizer play a vital role in increasing the crop yield. Commonly used fertilizer are nitrogen, phosphorus and potash. Phosphorus is the second major nutrient after nitrogen for plant growth which play a fundamental role in large number of enzymatic reaction that depend upon the energy transfer or phosphorylation (20). Recovery of applied Phosphorus reported in the literature is low (0.02-0.5%) in alkaline calcareous soil of Pakistan.

Materials and Methods

The present investigation entitled "Effect of different levels and sources of phosphorous on growth, biochemical changes and yield of wheat (*Triticum aestivum* L.) under sodic soil." was carried out at the Main Experimental Station (MES), Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) during *rabi* season of 2015-16. The experiment was laid down in randomized block design with three replications on wheat variety NW 1014 and pH of the soil is 9.4. Seven treatments were given and are comprised of T_1: Control, T_2: 60 kg /ha through SSP, T_3: 60 Kg Phosphorus /ha. through DAP, T_4: 80 Kg Phosphorus /ha. through SSP, T_5:80 Kg Phosphorus /ha. Through DAP, T_6:100 Kg phosphorus/ha. through SSP, T_7:100 Kg Phosphorus /ha. through DAP. Total chlorophyll content in leaf sample was estimated according to method of Arnon (1949) and expressed as mg/g fresh weight of leaves. Total carbohydrate content was determined according to the method described by Yemm and Willis (1954). The total soluble protein content was estimated by using method of Lowery *et al.*, (1951).

Results and Discussions

The mean data pertaining to total chlorophyll content in leaves, under various treatments are presented in Table-1. The total chlorophyll content in green leaves increased up to 30, 60, DAS and then declined. All the treatment showed increase in total chlorophyll content in green leaves that at 30, 60 and 90 DAS. Maximum increase in chlorophyll content was obtained with basal application of 80 kg ha^{-1} DAP (0.70, 1.56, and 0.60 mg g^{-1} fresh weight) at 30, 60 and 90 DAS followed by basal application of 100kg ha^{-1} SSP over control. However, minimum was recorded with control. High biochemical parameters content were analyzed due to 80 kg ha^{-1} DAP which might be due to enhanced cell division and increased chlorophyll development besides these phosphorous is critical in the metabolism of plant, playing a role in cellular energy transfer, respiration, and photosynthesis. It is also a structural component of the nucleic acids of genes and chromosomes and of many coenzymes, phosphoproteins and phospholipids in the plant that may contributes these parameters in plant. These results are strongly supported by, Alam, *et al.* (2002) [2] who observed the effects of different levels of zinc and phosphorus alone and in combination on wheat the concentration for the study were Zn: 0.0, 5.0, 10.0 and 20.0 mg and P 0.0, 20.0, 40.0, 60.0 mg the chlorophyll contents were generally increased at the lower level of Zn and P, while at the higher Zn and P levels the chlorophyll contents were decreased as compared to control.

The mean data pertaining to total carbohydrate content in dry leaves under various treatments are presented in Table-2. All the treatments showed significant increase in total carbohydrate content, at all the stages of observations over the control. However, the maximum increase in total carbohydrate content was recorded with basal application of 80 kg ha^{-1} DAP (218.08, 323.57 and 128.26 mg g^{-1} dry weight) at 30, 60 and 90 DAS followed by basal application of 100 kg ha^{-1} SSP were is minimum carbohydrate content in dry leaf noted under control. They also reported a significant positive influence of *Rhizobium* on carbohydrate content of mungbean. Chaudhary *et al.* (2003) [4] reported that the increasing level of P and S up to 75 kg ha^{-1} increased carbohydrate content in grain and N, P and S content in seed and straw.

Data pertaining to protein content in leaves under the different levels and sources of phosphorus are presented in Table-3 and examination of data revealed that the protein content in leaves influenced due to various treatments as compared to control. The protein content increased up to 60 DAS after that, it declined at 90 DAS. The maximum increased in protein content was recorded with basal application of 80 kg ha^{-1} DAP (1.61, 2.24 and 1.83 mg fresh weight) at 30, 60 and 90 DAS respectively followed by 100 kg ha^{-1}SSP over rest of the treatments. However, minimum protein content in leaf was analyzed in control. Parasher *et al.* (1999) observed that the application of P @ 60 kg P_2O_5 ha^{-1} showed substantial improvement in seed yield and quality parameters like protein tryptophane, methionine and fiber.

Table 1: Effect of different levels and sources of phosphorous on total chlorophyll content in leaves (mg g^{-1} fresh weight) of wheat under sodic soil

Treatments	Total Chlorophyll content in leaves		
	30 DAS	60 DAS	90 DAS
Control	0.51	1.5	0.40
60 kg ha^{-1} SSP	0.59	1.40	0.34
60 kg ha^{-1} DAP	0.62	1.43	0.35
80 kg ha^{-1} SSP	0.62	1.35	0.36
80 kg ha^{-1} DAP	0.70	1.56	0.60
100 kg ha^{-1} SSP	0.65	1.50	0.55
100 kg ha^{-1} DAP	0.63	1.33	0.27
SEm±	0.05	0.01	0.04
CD at (5%)	0.14	0.04	0.12

Table 2: Effect of different levels and sources of phosphorous on total carbohydrate content (mg g^{-1} dry weight) in leaves of wheat under sodic soil

Treatments	Total Carbohydrate content		
	30 DAS	60 DAS	90 DAS
Control	186.86	230.90	110.37
60 kg ha^{-1} SSP	188.53	238.96	116.04
60 kg ha^{-1} DAP	208.78	308.97	121.04
80 kg ha^{-1} SSP	210.91	319.78	126.13
80 kg ha^{-1} DAP	218.08	323.57	128.26
100 kg ha^{-1} SSP	217.21	321.33	127.12
100 kg ha^{-1} DAP	208.10	311.10	125.05
SEm±	0.29	0.57	0.36
CD at (5%)	0.41	1.76	1.09

Table 3: Effect of different levels and sources of phosphorous on protein content (mg g^{-1} fresh weight) in leaves of wheat under sodic soil

Treatments	Total protein content		
	30 DAS	60 DAS	90 DAS
Control	1.52	2.01	1.78
60 kg ha^{-1} SSP	1.54	2.14	1.81
60 kg ha^{-1} DAP	1.58	2.12	1.80
80 kg ha^{-1} SSP	1.57	2.17	1.81
80 kg ha^{-1} DAP	1.61	2.24	1.83
100 kg ha^{-1} SSP	1.53	2.19	1.82
100 kg ha^{-1} DAP	1.51	2.22	1.72
SEm±	0	0	0
CD at (5%)	0.01	0.011	0.0081

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