

Effect of different levels of phosphorus, sulphur and cultivars on growth and economics of chickpea (*Cicer arietinum* L)

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ABSTRACT

A field experiment was conducted during the Rabi season of 2013-14 at the Crop Research Farm, Department of Agronomy, Allahabad School of Agriculture, SHIATS, Allahabad, Uttar Pradesh to find out the effect of different levels of phosphorus, sulphur and cultivars on growth and economics of chickpea (*Cicer arietinum* L). The experiment was laid out in randomized block design with three replications. The treatments consisted of three phosphorus levels (40, 60 and 80 kg/ha), 3 levels of sulphur (15, 20 and 25 kg/ha) and two cultivars (Pusa-362 and Radhey) with plot size of 3 x 3 m (9 m²). The results revealed that treatment comprising Pusa-362 + P₂O₅ 60 kg/ha + sulphur 25 kg/ha recorded highest plant height (48.60 cm), number of branches per plant (7.66), number of nodules per plant (58.23), dry weight (7.93 g), harvest index (38.15), gross return (Rs 107790), net return (Rs 84342.72) and B-C ratio (4.59).

Keywords: Chickpea; phosphorus; sulphur; cultivars; growth; yield

INTRODUCTION

Chickpea (*Cicer arietinum* L) is the third most widely grown grain legume in the world after bean and soybean (Soltani et al 2006). It plays an important role in human nutrition due to its high protein content (17-23%) and because of being a good source of carbohydrates, minerals and trace elements (Namvar and Sharifi 2011). It is a cheap source of high quality protein in the diets of millions of people in developing countries who cannot afford animal protein for balanced nutrition (Zia Ul-Haq et al 2007). It is also used as feed for livestock and has a significant role in farming systems (Singh 1997). It is an integral part of the cropping system of the farmers all over India because this crop fits well in the crop rotation and mixed cropping. It has multipurpose use and ability to grow under the condition of low fertility and varying conditions of soil and climate (Nawange et al 2011). Chickpea accounts for about 45 per cent of total pulses produced in India. Similar to the case of other pulses India is the major chickpea producing country contributing to over 75 per cent of total production of

the world (Anon 2016). The main chickpea producing states are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra and Andhra Pradesh. Phosphorus is one of the most important nutrients for plant and chickpea also responds significantly to phosphorus application. Phosphorus contributes directly to both yield and quality of chickpea. It plays an important role in physiological functions of plant. It is a constituent of adenosine di-phosphate (ADP), sugar phosphate, nucleic acid, proteins and several co-enzymes which are of great importance in energy transformation and metabolic processes of the plants. The nitrogen fixation is much accelerated when optimum quantity of phosphorus is available in the soil.

Sulphur is now recognized as major plant nutrient along with nitrogen, phosphorus and potassium. It is essential for the growth and development of all crops without exception. Most of the sulphur by the plants is absorbed through the roots in the form of sulphate (SO₄⁻²). Sulphur deficiency is becoming more critical with each passing year which is severely restricting crop yield, produce quality, nutrient use

efficiency and economic returns in millions of farms. Like any essential nutrient sulphur also has certain specific functions to perform in the plant. Thus sulphur deficiency can only be corrected by the application of sulphur fertilizer (Tandon and Messick 2007).

MATERIAL and METHODS

A field experiment was conducted during Rabi season of 2013-2014 at the Crop Research Farm, Department of Agronomy, Allahabad School of Agriculture, SHIATS, Allahabad, Uttar Pradesh. The soil of the experimental area was sandy loam in texture and slightly alkaline (pH 7.4). The available nitrogen, phosphorus and potash were 225, 21.50 and 87 kg/ha respectively. The treatment comprised three levels of P_2O_5 (40, 60 and 80 kg/ha), three levels of sulphur (15, 20 and 25 kg/ha) and two cultivars (Pusa-362 and Radhey). These treatments were replicated thrice in randomized block design in plot size of 3 x 3 m (9 m²). The land was prepared after giving one light irrigation followed by ploughing and planking. Sulphur and phosphorus were applied through micronized sulphur and DAP respectively as per treatments in furrows before sowing. A uniform dose of nitrogen (9.44 kg/ha through DAP) and potash (26.40 kg/ha through muriate

of potash) was applied as basal dose at the time of sowing. Chickpea varieties Pusa-362 and Radhey were sown on 7 November 2013 at row spacing of 30 cm using seed rate of 100 kg/ha. The total rainfall received during the crop season was 32.33 mm. Crop was harvested on 24 April 2014.

RESULTS and DISCUSSION

Among the all phosphorus and sulphur levels and cultivars the treatment Pusa-362 + P_2O_5 60 kg/ha + S 25 kg/ha proved best among all the treatments wrt plant height, number of branches per plant, nodules per plant, dry weight and harvest index. Highest plant height at 100 DAS (48.60 cm), number of branches per plant at 100 DAS (7.66), nodules per plant (29.46), dry weight (7.93 g) and harvest index (38.15) were recorded in treatment P_2O_5 60 kg/ha + S 25 kg/ha in Pusa-362 cultivar. Similar findings were recorded by Deo and Khaldelwal (2009). This may be attributed to greater availability of phosphorus due to these treatments and better growth and yield attributes. Phosphorus is an important nutrient in chlorophyll formation and plays an important role in nitrogen availability to plant. An increase in the N supply not only stimulates growth but also changes morphology

Table 1. Effect of different levels of phosphorus, sulphur and cultivars on growth and economics of chickpea

Treatment	Plant height (cm)	Number of branch /plant	Number of nodule /plant	Dry weight (g)	Harvest index (%)	Gross return (Rs/ha)	Net return (Rs/ha)	B-C ratio
Pusa-362 + P_2O_5 40 kg/ha+ S 15 kg/ha	37.56	6.26	26.10	5.20	32.41	61580	39967.20	2.84
Pusa-362 + P_2O_5 40 kg/ha + S 20 kg/ha	36.18	5.53	24.40	5.83	37.09	67770	54194.76	3.06
Pusa-362 + P_2O_5 40 kg/ha + S 25 kg/ha	31.91	7.33	26.20	5.03	35.52	74850	52293.24	3.31
Pusa-362 + P_2O_5 60 kg/ha + S 15 kg/ha	35.59	6.86	25.86	5.53	33.63	71050	48516.72	3.15
Pusa-362 + P_2O_5 60 kg/ha + S 20 kg/ha	30.18	6.66	24.63	3.96	35.37	78820	55844.72	3.43
Pusa-362 + P_2O_5 60 kg/ha + S 25 kg/ha	48.60	7.66	29.46	7.93	38.15	107790	84342.72	4.59
Pusa-362 + P_2O_5 80 kg/ha + S 15 kg/ha	30.89	6.66	24.70	5.16	37.63	82720	59260.20	3.52
Pusa-362 + P_2O_5 80 kg/ha + S 20 kg/ha	34.20	6.60	24.60	6.93	37.33	88670	64739.00	3.70
Pusa-362 + P_2O_5 80 kg/ha + S 25 kg/ha	30.88	6.53	25.00	5.06	35.90	77890	53486.20	3.19
Radhey + P_2O_5 40 kg/ha + S 15 kg/ha	43.56	6.86	25.80	6.90	26.46	56910	35297.24	2.63
Radhey + P_2O_5 40 kg/ha + S 20 kg/ha	39.99	6.13	27.10	5.73	33.13	67730	45645.24	3.06
Radhey + P_2O_5 40 kg/ha + S 25 kg/ha	47.16	6.73	25.50	6.96	27.21	67660	45103.24	2.99
Radhey + P_2O_5 60 kg/ha + S 15 kg/ha	39.39	6.40	24.53	5.80	31.12	64450	41946.72	2.86
Radhey + P_2O_5 60 kg/ha + S 20 kg/ha	44.17	6.06	26.46	5.53	30.31	70190	47214.72	3.05
Radhey + P_2O_5 60 kg/ha + S 25 kg/ha	40.02	7.33	27.73	4.53	32.06	77350	53902.72	3.29
Radhey + P_2O_5 80 kg/ha + S 15 kg/ha	43.54	7.53	25.93	5.46	29.29	67740	44280.20	2.88
Radhey + P_2O_5 80 kg/ha + S 20 kg/ha	42.71	7.60	25.73	7.06	26.48	64030	40099.00	2.67
Radhey + P_2O_5 80 kg/ha + S 25 kg/ha	47.63	7.13	24.70	6.40	30.74	67670	43266.30	2.77
F-test	S	S	S	S	-	-	-	-
SEd _±	5.12	0.67	1.36	1.05	-	-	-	-
CD _{0.05}	10.36	1.35	2.76	2.14	-	-	-	-

of plant. Phosphorus also enhances nodule formation in leguminous crops. Shivran and Chandra (2012) reported that application of sulphur (25 kg/ha) significantly increased the plant growth, yield attributes and number of nodules per plant in chickpea.

Economics

The highest gross return (Rs 107790/ha), net return (Rs 84342.72/ha) and benefit-cost ratio (4.59) were registered in treatment comprising Pusa-362 + P₂O₅ 60 kg/ha + S 25 kg/ha compared to the lowest values (Rs 56910/ha, Rs 35297.24/ha and 2.63 respectively) in the treatment comprising Radhey + P₂O₅ 40 kg/ha + S 15 kg/ha. The data revealed that application of 60 kg/ha phosphorus and 25 kg/ha sulphur increased higher net return and B-C ratio compared to other treatments.

REFERENCES

- Anonymous 2016. All India Coordinated Research Project on Chickpea. ICAR, Kanpur, Uttar Pradesh, India.
- Deo C and Khaldelwal RB 2009. Effect of P and S nutrition on yield and quality of chickpea (*Cicer arietinum* L). Journal of the Indian Society of Soil Science **57(3)**: 352-356.
- Namvar A and Sharifi RS 2011. Phenological and morphological response of chickpea (*Cicer arietinum* L) to symbiotic and mineral nitrogen fertilization. Žemdirbystė (Agriculture) **98(2)**: 121-130.
- Nawange DD, Yadav AS and Singh RV 2011. Effect of phosphorus and sulphur application on growth, yield attributes and yield of chickpea (*Cicer arietinum* L). Legume Research **34(1)**: 48-50.
- Shivran RK and Chandra P 2012. Productivity, profitability and protein content of chickpea (*Cicer arietinum* L) as influenced by farm yard manure, phosphorus and sulphur application. Trends in Biosciences **5(2)**: 104-106.
- Singh KB 1997. Chickpea (*Cicer arietinum* L). Field Crops Research **53**: 161-170.
- Soltani A, Robertson MJ, Mohammad-Nejad Y and Rahemi-Karizaki A 2006. Modeling chickpea growth and development: leaf production and senescence. Field Crops Research **99(1)**: 14-23.
- Tandon HLS and Messick DL 2007. Practical of sulphur guide. The Sulphur Institute, Washington, DC, pp 1-2.
- Zia Ul-Haq M, Iqbal S, Ahmad S, Imran M, Niaz A and Bhanger MI 2007. Nutritional and compositional study of Desi chickpea (*Cicer arietinum* L) cultivars grown in Punjab, Pakistan. Food Chemistry **105**: 1357-1363.