

## Research Article

# Productivity and Growth of Urdbean as Influenced by Thiourea and Phosphorus Fertilization under Rainfed Semi-arid conditions of Rajasthan

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## Abstract

The study was undertaken at S.K.N. College of Agriculture, Jobner, Rajasthan during *kharif* season of 2016-17 on sandy loam soil to study the effect of thiourea and phosphorus fertilization on performance of urdbean. The experiment consisted of five thiourea treatments (control, seed soaking with 500 ppm thiourea solution, thiourea 500 ppm foliar spray at 20 DAS (Days after sowing), thiourea 500 ppm foliar spray at 45 DAS and thiourea 500 ppm foliar spray at 20 DAS + 45 DAS) and four Phosphorus levels (control, 20, 40 and 60 kg P<sub>2</sub>O<sub>5</sub>/ha). The total 20 treatment combinations were tested in factorial randomized block design with three replications. The results showed that foliar spray of 500 ppm thiourea at 20 DAS + 45 DAS significantly increased the growth parameters, yield attributes and yield of urdbean. Among phosphorus levels application of 40 kg P<sub>2</sub>O<sub>5</sub>/ha produced significantly higher growth parameters, yield attributes and yield of urdbean under rainfed semi-arid conditions of Rajasthan.

**Keywords:** Urdbean, Thiourea, Phosphorus, Yield attributes and Productivity.

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## Introduction

Pulses play a vital role in Indian food chain. Urdbean [*Vigna mungo* (L.) Hepper] is one of the major pulse crop grown throughout the country during both in summer and rainy season. This leguminous crop containing 24% protein, 60% carbohydrate, 1.3% fat, 3.2% minerals, 0.9% fiber, 154 mg calcium, 385 mg phosphorus, 9.1 mg iron and small amount of vitamin B-complex. It is grown on 3.06 mha area with a production of 1.96 mT and productivity of 555 kg/ha in our country [1]. Being a short duration leguminous crop, it fits well in various multiple and intercropping systems. After removing pods, its plant may be used as good quality green or dry fodder or green manure. As a legume crop, it is also enriches soil by fixing atmospheric nitrogen. Urdbean contributes about 13 per cent of total area and 10 per cent production of pulses in our country. Thiourea contains 42.1 per cent sulphur and 36.8 per cent nitrogen and its use recognized as plant growth regulator [2] may be helpful in this regard. Soaking of seeds and foliar spray of thiourea have been reported not only to improve growth and development of plants, but also the dry matter partitioning for increased grain yield [3]. Phosphorus deficiency is usually the most important factor for poor nodulation and low yield of leguminous crops including urdbean in all type of soils. Crop responses to applied phosphorus have been reported in all type of soils as it is called master key element for increasing the yield. Apart from its essential role in growth and development of roots, phosphorus is also necessary for growth of Rhizobium bacteria responsible for biological fixation of N to increase the efficiency of pulses as soil renovator and serves the dual purpose of increasing yield of main as well as succeeding crop. An adequate supply of phosphorus has been reported good for better growth, yield, quality and enormous nodule formation in legumes [4].

## Materials and Methods

The field experiment was conducted during *kharif* season at SKN College of Agriculture, Jobner, Jaipur (Rajasthan) comprising 20 treatment combinations of five thiourea treatments (control, seed soaking with 500 ppm thiourea solution, thiourea 500 ppm foliar spray at 20 DAS, thiourea 500 ppm foliar spray at 45 DAS and thiourea 500 ppm foliar spray at 20 DAS + 45 DAS) and four Phosphorus levels (control, 20, 40 and 60 kg P<sub>2</sub>O<sub>5</sub>/ha). Treatments were tested in randomized block design with three replications. The soil of experimental plots was loamy sand in texture, slightly alkaline in reaction (pH 8.2), low in organic carbon (0.15%), available nitrogen (132.4 kg/ha) and medium in available phosphorus (16.26 kg P<sub>2</sub>O<sub>5</sub>/ha) and potassium (154.2 kg K<sub>2</sub>O/ha) content. The experimental crop urdbean was sown through *kera* method in lines with 30 x 10 cm crop geometry. As per treatment whole amount of phosphorus was applied through DAP and drilled 8-10 cm deep in soil at the time of sowing. In case of thiourea treatments, seed soaking and foliar spray of thiourea 500 ppm solution at different growth stages (20 DAS, 45 DAS

and 20 DAS + 45 DAS) were done as per treatments. A uniform dose of 25 kg N/ha was applied to all the plots by adjusting the N supplied through DAP and remaining through urea at the time of sowing. All the observations on growth, yield attributes and yields of urdbean were recorded as per schedule.

## Results and Discussion

### *Growth attributes of urdbean*

Foliar spray of thiourea 500 ppm at 20 DAS + 45 DAS significantly increased the growth parameters *viz.*, plant height, number of branches/plant, dry matter accumulation/m row length, total and effective nodules/plant over thiourea application at 20 DAS, thiourea foliar application at 45 DAS, thiourea as seed soaking and control (**Tables 1** and **2**). This might be happened due to stimulated dark fixation of CO<sub>2</sub> through thiourea in embryonic axes which has resulted into improved photosynthetic efficiency and other physiological processes in plants. Similar findings were also reported by [2], [4], and [5]. Among phosphorus levels application of phosphorus at 40 kg/ha significantly enhanced the growth attributes of urdbean *viz.*, plant height, number of branches/plant, dry matter accumulation, number of total and effective nodules/plant over preceding levels but remained at par with 60 kg/ha. It can be ascribed to the better nutritional environment in the root zone for growth and development of the crop as well as in plant system. These results are in cognizance with the findings of [6] and [7] in green gram and [8] in urdbean.

**Table 1** Effect of thiourea and phosphorus fertilization on growth attributes of urdbean

Treatments	Plant height (cm)		No. of branches/plant
	40 DAS	At harvest	
<b>Thiourea application (500 ppm)</b>			
Control	34.3	43.7	6.0
Seed soaking	37.8	48.0	7.5
Foliar spray at 20 DAS	43.1	53.0	8.6
Foliar spray at 45 DAS	41.7	51.7	8.1
Foliar spray at 20 DAS + 45 DAS	45.9	56.7	9.7
SEm±	0.9	1.2	0.2
CD (P=0.05)	2.6	3.6	0.6
<b>Phosphorus levels (kg P<sub>2</sub>O<sub>5</sub>/ha)</b>			
Control	33.9	44.1	6.1
20	39.7	50.2	7.9
40	43.6	53.8	8.8
60	45.1	54.4	9.1
SEm±	0.8	1.1	0.2
CD (P=0.05)	2.4	3.2	0.5
CV (%)	7.9	8.5	8.8

### *Yield attributes and yield of urdbean*

Yield attributes and yield (**Tables 3** and **4**) of urdbean showed that application of thiourea twice at initiation of branches and initiation of flowers significantly increased yield attributes *viz.*, number of pods per plant, number of seeds per pod, test weight and seed, straw and biological yields (1234, 2351 and 3584 kg/ha) over thiourea spray at 20 DAS, thiourea foliar spray at 45 DAS, thiourea as seed soaking and control. The increase in yield attributes and yield obtained with thiourea application was most probably due to increased crop photosynthesis favoured by both improved photosynthetic efficiency and source to sink relationship. Similar result there also reported by [9] and [2] in clusterbean, [10] in mothbean and [11] in mungbean. In case of phosphorus fertilization (Tables 3 and 4) application of phosphorus at 40 kg/ha produced significantly higher yield attributes *viz.*, number of pods per plant, number of seeds per pod, test weight and seed, straw and biological yields (1168, 2265 and 3433 kg/ha) than 20 kg/ha and control and showed statistical equivalence with 60 kg P<sub>2</sub>O<sub>5</sub>/ha. Since, an adequate supply of phosphorus during early stage of growth is considered important in promoting vegetative growth and branching by influencing cell division and elongation in meristematic cells, thereby increasing the sink in terms of flowering and seed setting [12]. Moreover, the favourable effect of P fertilization on yield attributes might be due to the fact that phosphorus is well known for its role as 'energy currency' and plays a key role in energy transformation in various metabolic processes [13].

**Table 2** Effect of thiourea and phosphorus fertilization on dry matter and on nodules of urdbean

Treatments	Dry matter accumulation (g/m <sup>2</sup> )		Nodules/ plant	Effective nodules/ plant
	40 DAS	At harvest		
<b>Thiourea application (500 ppm)</b>				
Control	31.30	90.71	27.81	26.35
Seed soaking	35.48	107.28	30.77	28.78
Foliar spray at 20 DAS	40.04	128.00	33.29	31.47
Foliar spray at 45 DAS	39.37	121.27	32.89	31.05
Foliar spray at 20 DAS+45 DAS	43.59	136.47	35.60	33.76
SE <sub>m±</sub>	1.20	2.93	0.74	0.78
CD (P=0.05)	3.44	8.37	2.10	2.22
<b>Phosphorus levels (kg P<sub>2</sub>O<sub>5</sub>/ha)</b>				
Control	31.54	92.35	27.33	25.48
20	36.92	112.51	31.35	29.41
40	40.81	126.51	34.25	32.54
60	42.55	135.61	35.36	33.69
SE <sub>m±</sub>	1.08	2.62	0.66	0.69
CD (P=0.05)	3.08	7.49	1.88	1.98
CV (%)	10.98	8.69	7.95	8.88

**Table 3** Effect of thiourea and phosphorus fertilization on yield attributing characters of urdbean

Treatments	Number of pods /plant	Number of seeds/pod	Test weight (g)
<b>Thiourea application (500 ppm)</b>			
Control	16.82	5.29	33.10
Seed soaking	20.77	6.31	35.42
Foliar spray at 20 DAS	23.96	7.13	38.50
Foliar spray at 45 DAS	23.12	6.89	37.87
Foliar spray at 20 DAS+45 DAS	25.50	7.66	40.77
SE <sub>m±</sub>	0.50	0.18	0.73
CD (P=0.05)	1.43	0.51	2.08
<b>Phosphorus levels (kg P<sub>2</sub>O<sub>5</sub>/ha)</b>			
Control	16.60	5.60	33.54
20	21.54	6.45	36.88
40	24.55	7.22	38.85
60	25.45	7.35	39.25
SE <sub>m±</sub>	0.45	0.16	0.65
CD (P=0.05)	1.28	0.46	1.86
CV (%)	7.84	9.29	6.80

**Table 4** Effect of thiourea and phosphorus fertilization on yield performance of urdbean

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)
<b>Thiourea application (500 ppm)</b>			
Control	775	1537	2313
Seed soaking	982	1927	2908
Foliar spray at 20 DAS	1127	2197	3324
Foliar spray at 45 DAS	1100	2163	3263
Foliar spray at 20 DAS+45 DAS	1234	2351	3584
SE <sub>m±</sub>	22.35	52.36	90.17
CD (P=0.05)	63.88	149.64	257.72
<b>Phosphorus levels (kg P<sub>2</sub>O<sub>5</sub>/ha)</b>			
Control	774	1585	2359
20	1046	1978	3024
40	1168	2265	3433
60	1186	2312	3498
SE <sub>m±</sub>	19.99	46.83	80.65
CD (P=0.05)	57.13	133.85	230.51
CV (%)	7.42	8.91	10.15

## Conclusion

The results of this experiment indicates that twice foliar spray of thiourea 500 ppm at 20 DAS and 45 DAS significantly increased growth parameters, yield attributes and yield of urdbean crop under semi-arid rainfed conditions. While, application of phosphorus at 40 kg/ha produced significantly higher growth parameters, yield attributes and yield but being remained at par with 60 kg/ha phosphorus.

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