International J. Seed Spices 3(2), July 2013:70-73

Effect of phosphorus and sulphur levels on the performance of *Nagauri Methi* (*Trigonella corniculata* L.) under semi arid areas of Rajasthan

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Abstract

A field experiment was conducted during *rabi* 2005-06 at research farm of Adaptive Trial Centre, Ajmer to study the response of *Nagauri Methi* i.e. also called *Kasuri Methi* (*Trigonella corniculata* L.) to phosphorus and sulphur. In this study three levels of phosphorus (0, 40 and 60 kg ha^{-1}) and three levels of sulphur (0, 30 and 45 kg ha^{-1}) consisted of nine treatments were taken under factorial RBD with three replications. Growth parameters and yield of dried leaves of the crop increased almost linearly with increasing levels of phosphorus, however influence of sulphur was marginal on both growth as well as marketable yield. Maximum plant height (11.8 cm), numbers of trifoliate leaves (7.7) and dried leaves yield (21.56 q ha^{-1}) was obtained with 60 kg P_2O_5 + 45 kg S ha^{-1} which was at par with 60 kg P_2O_5 + 30 kg S ha^{-1}. Maximum gross returns (Rs.140140 ha^{-1}), net return (Rs.105522 ha^{-1}) and returns due to treatment (Rs.62595 ha^{-1}) were recorded in 60 kg P_2O_5 + 45 kg S. However, highest benefit: cost ratio (4.06) was recorded from the application of 60 kg P_2O_5 + 30 kg S ha^{-1}, which exhibited gross returns (Rs. 139490 ha^{-1}), net returns (Rs. 105172 ha^{-1}) and returns due to treatment (Rs. 61945 ha^{-1}).

Key words : Nagauri *methi* (k*asuri methi*), *trigonella corniculata,* plucking, phosphorus, sulphur, dry leaves

Introduction

Kasuri Methi (*Trigonella corniculata* L.), a minor spice crop, is emerging as a new cash crop in peripheral areas of Nagaur (Rajasthan), India due to its lucrative returns, where it is popularly known as "*Nagauri Methi* or *Pan Methi* ". Dried leaves of this plant are used as a natural flavoring agent in various curries and are odorous constituent of curry powder. In spite of being a cash crop, till today it was devoid of due privilege in terms of nutrition, though there is immense potential to increase foliage yield by balanced fertilization. Being a leguminous crop phosphorus and sulphur are the nutrients of great concern. Both are structural elements and are main constituent of nucleic acid, phospholipids and amino acids. It is reported that fenugreek responded up to 90 kg phosphorus (Halesh *et al*., 2).

Adequate supply of phosphorus and sulphur is essential for proper growth, leaves colour and flavour of *Nagauri Methi*. Deficiency of phosphorus results in discoloration of foliage leads to inferior quality and yield. Sulphur deficiency leads in poor vegetative growth and yellowing of young leaves resulting in reduction in quantity as well as quality of dried foliage, the marketable produce. Sulphur is also a main constituent of various flavoring compounds, the essential oils. Soils of arid and semi arid areas of Rajasthan are mostly low in phosphorus and deficient in sulphur. Despite these, little efforts have been made so far in to standardize phosphorus and sulphur levels especially for *Nagauri Methi*. Keeping these views in consideration, the investigation on the performance of *Nagauri Methi* under different levels of phosphorus and sulphur was carried out for maximization of yield and returns.

Materials and methods

The present investigation on "Effect of phosphorus and sulphur levels on dry leaves of *Nagauri Methi* (*Trigonella corniculata* L.) under semi arid areas of Rajasthan*"* was carried out at research farm of Adaptive Trial Centre, Tabiji, Ajmer during 2005-06. The soil was sandy loam in texture, alkaline in reaction (pH 8.1) with 0.21 % organic carbon and 152, 14.2 and 185.5 kg ha^{-1} of available N, P and K with deficient in sulphur (8.4 ppm). In this study, 3 levels of phosphorus (0, 40 & 60kg P_2O_5 ha^{-1}) and 3 levels of sulphur (0, 30 & 45 kg ha^{-1}) consisting of nine treatment combinations were tried in randomized block design with three replication. Treatments were ,T_1-P_0S_0 (0 kg P_2O_5 + 0 kg S ha^{-1}) T_2-P_0S_{30} (0 kg P_2O_5 +30 kg S ha^{-1}),T_3- P_0S_{45} (0 kg P_2O_5,+ 45 kg S ha^{-1}), T_4- $P_{40}S_0$ (40 kg P_2O_5 + 0 kg S ha^{-1}),T_5- $P_{40}S_{30}$ (40 kg P_2O_5 + 30 kg S ha^{-1}), T_6- $P_{40}S_{45}$ (40 kg P_2O_5 + 45 kg S ha^{-1}),T_7- $P_{60}S_0$ (60 kg P_2O_5 + 0 kg S ha^{-1}) T_8- $P_{60}S_{30}$ (60 kg P_2O_5 + 30 kg S ha^{-1}) and T_9- $P_{60}S_{45}$ (60 kg P_2O_5 +45 kg S ha^{-1}). Phosphorus and sulphur were

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Table 1. Effect of P and S on plant height (cm) of *Nagauri Methi.*

Sulphur doses	**Doses of phosphorus**			
	P_0	**P_{40}**	**P_{60}**	**Mean**
S_0	5.8	8.9	11.1	8.6
S_{30}	6.4	9.4	11.5	9.1
S_{45}	6.6	9.7	11.8	9.4
Mean	6.27	9.33	11.5	9.3
CD (*P*=0.05) for phosphorus - 0.94				
CD (*P*=0.05) for sulphur - NS				
CD (*P*=0.05) for PXS - 1.63				

Table 2. Effect of P and S on number of trifoliate leaves plant^{-1} of *Nagauri Methi*.

Sulphur doses	**Doses of phosphorus**			
	P_0	**P_{40}**	**P_{60}**	**Mean**
S_0	4.3	6.1	7.0	5.8
S_{30}	4.6	6.5	7.4	6.1
S_{45}	4.8	6.7	7.7	6.4
Mean	4.6	6.4	7.4	6.1
CD (*P*=0.05) for phosphorus - 0.81				
CD (*P*=0.05) for sulphur - NS				
CD (*P*=0.05) for PXS - 1.40				

Table 3. Effect of P & S on marketable yield (q ha^{-1} dry leaf weight) of *Nagauri Methi.*

Sulphur doses	**Doses of phosphorus**			
	P_0	**P_{40}**	**P_{60}**	**Mean**
S_0	11.93	15.23	19.66	15.60
S_{30}	13.26	16.00	21.46	16.90
S_{45}	14.80	17.43	21.56	17.93
Mean	13.33	16.22	20.89	16.81
CD (*P*=0.05) for phosphorus - 2.67				
CD (*P*=0.05) for sulphur - NS				
CD (*P*=0.05) for PXS - 4.62				

Table 4. Economics of *Naguari Methi* as influenced by phosphorus and sulphur.

Treatments	Dried leaves yield (q ha^{-1})	Gross returns (Rs.)	Treatment Cost (Rs.)	Total cost (Rs.)	Returns due to treatment (Rs.)	Returns increased over control (%)	Net returns (Rs.)	B: C ratio
T_1-P_0S_0	11.93	77545	-	32450	-	-	45095	2.39
T_2-P_0S_{30}	13.26	86190	600	33050	8645	11.15	53140	2.61
T_3-P_0S_{45}	14.80	96200	900	33350	18655	24.06	62850	2.88
T_4-$P_{40}S_0$	15.23	98995	849	33299	21450	27.66	65696	2.97
T_5-$P_{40}S_{30}$	16.00	104000	1449	33899	26455	34.12	70101	3.07
T_6-$P_{40}S_{45}$	17.43	113295	1749	34199	35750	46.10	79096	3.31
T_7-$P_{60}S_0$	19.66	127790	1268	33718	50245	64.79	94072	3.79
T_8-$P_{60}S_{30}$	21.46	139490	1868	34318	61945	79.88	105172	4.06
T_9-$P_{60}S_{45}$	21.56	140140	2168	34618	62595	80.72	105522	4.05
CD(P=0.05)	4.62							

Sale price of *Nagauri Methi* in 2005-06 Rs.65 kg^{-1} of dried leaves.

applied as basal dose through DAP fertilizer and commercial sulphur, respectively. A uniform dose of 40 kg nitrogen was applied into three splits 1/3 as basal and rest two third at just after first and third plucking. Seed of *Nagauri Methi* collected from growing areas of Nagaur was sown on 10th November. Crop was harvested by plucking of the leaves and young shoots. First plucking was performed at 35 days after sowing and successive pluckings were done at 15 days interval. Irrigations were given after every plucking by check basin system. Harvested foliage was dried under partial shade and weighed to draw inference. Economics was worked out on the basis of prevailing market prices of inputs and output.

Results and discussion

Growth parameters and marketable yield

Effect of phosphorus

Effect of different doses of phosphorus on growth parameters (plant height and trifoliate leaves plant^{-1}) and marketable yield (dried leaves) of *Nagauri Methi* were depicted in Table-1, 2 and 3. Growth of *Nagauri Methi* was significantly influenced by the application of various levels of phosphorus. The highest level of phosphorus (60 kg ha^{-1}) gave the maximum plant height (11.5 cm) and trifoliate leaves plant^{-1} (7.4) at 35 DAS. Similarly, maximum dried leaves yield (20.89 q ha^{-1}) was obtained with 60 kg phosphorus, which was significantly superior over P_O and P_{40}, increase in dried leaves yield was recorded with successive phosphorus levels. Phosphorus plays a significant role in growth and development of legume plants. Energy storage and transfer are the most important functions of phosphorus and its adequate availability has been found to have positive impact on growth, yield, nodule formation and activities of symbiotic nitrogen fixing bacteria. These findings are in corroboration of the results of Halesh *et al*., (2), Nehra *et al*., (3) and Sheoran *et al.,* (4).They recorded significant increase in yield attributes and yield of fenugreek up to 90 kg, 40 kg and 60 kg phosphorus ha^{-1}, respectively.

Effect of sulphur

Application of sulphur registered a marginal increase in growth parameters and dried leaves yield. Maximum values of growth parameters *i.e.* plant height (9.4 cm) and number of trifoliate leaves (6.4) and dried leaves weight (17.93 q ha^{-1}) was recorded from 45 kg sulphur, however, it was at par with 30 kg sulphur, might be due to better capacity of sulphur uptake by the crop even from deficient

soils. Sulphur is an important structural constituent of amino acids and vitamins. It has positive effect on plant growth, development and root nodulation which consequently enhances growth, yield attributes and seed yield. Dayanand *et.al.* (1) has also reported similar findings in fenugreek crop.

Interaction effect of phosphorus and sulphur

Plant growth parameters and marketable yield of *Nagauri Methi* were influenced significantly with the combined application of phosphorus and sulphur (Table-1, 2 and 3).The maximum plant height (11.8 cm), maximum number of trifoliate leaves(7.7) with highest yield (21.56 q ha^{-1}) were recorded under $P_{60}S_{45}$ treatment combination. Though the influence of $P_{60}S_{30}$ treatment combination for all the parameters was at par with $P_{60}S_{45}$ treatment combination. These results are in the agreement of Dayanand *et.al* . (1).

Economics

The maximum gross returns (Rs.140140),net return (Rs.105522) and returns due to treatment (Rs.62595 / ha) were recorded with application of 60 kg phosphorus + 45 kg sulphur/ha closely followed by application of 60 kg phosphorus+30 kg sulphur ha^{-1} (Table 4). However, highest benefit: cost ratio of 4.06 was registered from P_{60} S_{30}.

It is concluded from this study that application of 60 kg ha^{-1} phosphorus and 30 kg ha^{-1} sulphur exhibited better growth and higher marketable yield which consequently fetch the good returns with maximum B: C ratio.

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Received : January 2013; Revised : March 2013; Accepted : May 2013.