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Short Communications

Leaf and seed yield of *nagauri methi* (*Trigonella corniculata*) as influenced by seed rates and nitrogen levels

MOTILAL MEHRIYA[1], UMA NATH SHUKLA[1], P K UPADHYAY[1]*, HITESH BORANA[1] and RAJIV KUMAR SINGH[2]

Agriculture University, Jodhpur, Rajasthan 342 342, India

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Nagauri methi (*Trigonella corniculata* L.), a minor spice crop, is emerging as a new cash crop in peripheral areas of Nagaur (Rajasthan) due to its profitable returns, where it is popularly known as "*Kasuri Methi* or *Pan Methi"*. Green leaves are used in making various food dishes due to its special aroma and taste. Dried leaves of the plants are used as a natural flavouring agent in various curries, vegetables, pickles etc. and it contains abundant vitamin-A, vitamin-C, carbohydrates, calcium, iron and protein (Datta *et al*. 2017). Farmers of Naguar and Jodhpur regions are unknowingly used a very high seed rate of 100 kg/ha to even up to 150 kg/ha. The high seed rate affects leaf production and quality of leaf greatly. Moreover, using high seed rate also increase cost of cultivation and inter-plant competition that results in poor harvest of crop with lesser aroma in leaf. Once the crop felt inter/intra plant competition for nutrient, light and moisture, the synthesis of flavoring agent like 2-methoxy, 4-vinylphenol (Pasricha and Gupta 2014) get restricted and factually poor harvest with lesser aroma in leaf (Godara *et al.* 2013). Nitrogen as an essential part of amino acids, nucleic acids, nucleotides, enzymes, coenzymes and vitamins which encourages the vegetative growth of plants (Korus and Lisiewska 2009), therefore, nitrogen is directly related to the vegetative growth of plants particularly formation of leaves (Mehta *et al.* 2010 and Shukla *et al.* 2015). The leaf of *nagauri methi is* harvested in different stalled cutting from mother plants. Therefore, to get good vegetative growth after each cutting, nitrogen is essential for better growth and development (Tunctruk *et al.* 2011). Keeping these views in consideration, the investigation on the performance of *nagauri methi* under different seed rates and levels of nitrogen was carried out at Agricultural Research Station, Mandor, Jodhpur for maximization of yield and returns.

The study was carried out at Agricultural Research Station, Mandor, Jodhpur during *rabi* 2014–15 and 2015–16. Geographically, it is situated between 26º 15' N to 26º 45' N latitude and 73º 00' E to 73º 29' E longitude at an altitude of 231 m above mean sea level. The soil was loamy sand in texture, slightly alkaline in reaction (*p*H 7.9), low in organic carbon (0.13%) and available nitrogen (184 kg/ha). The field experiment was laid out in Factorial Randomized Block Design (FRBD) and replicated thrice. The experiment consisted of three levels of seed rates (50, 75 and 100 kg/ha) and four levels of N (0, 15, 30 and 45 kg/ha). The seed rate and N levels laid out with twelve treatment combinations, i.e. 50 kg/ha seed rate and 0 kg N/ha (S_1N_0), 50 kg/ha seed rate and 15 kg N/ha (S_1N_1), 50 kg/ha seed rate and 30 kg N/ha (S_1N_2), 50 kg/ha seed rate and 45 kg N/ha (S_1N_3), 75 kg/ha seed rate and 0 kg N/ha (S_2N_0), 75 kg/ha seed rate and 15 kg N/ha (S_2N_1), 75 kg/ha seed rate and 30 kg N/ha (S_2N_2), 75 kg/ha seed rate and 45 kg N/ha (S_2N_3), 100 kg/ha seed rate and 0 kg N/ha (S_3N_0), 100 kg/ha seed rate and 15 kg N/ha (S_3N_1), 100 kg/ha seed rate and 30 kg N/ha (S_3N_2) and 100 kg/ha seed rate and 45 kg N/ha (S_3N_3). Cutting wise fresh leaf weight and dry leaf weight and seed yield were recorded as per treatment combinations. Economics were also calculated and compared for the selection of superior treatment combination. All the data were statistically analyzed (Panse and Sukhatme 1985) to draw a valid conclusion.

The data (Table 1) indicated that significantly higher fresh weight of leaf (8248 kg/ha) was obtained when *nagauri methi* was sown with seed rate of 100 kg/ha under 3rd cutting followed by 75 kg seed rate/ha (Table 1). However, mean data for two consecutive years, i.e. *rabi* 2014–15 and 2015–16 revealed that sowing of *nagauri methi* with the use of 100 kg/ha seed rate recorded significantly higher fresh leaf weight from first to fifth cutting (32794 kg/ha) at different intervals which was 2.85 and 17.09% higher over application of 75 kg and 50 kg/ha respectively. Further, data of two years analyzed and found that sowing of *nagauri*

Present address: Agriculture University, Jodhpur, Rajasthan; [2]ICAR-Indian Agricultural Research Institute, New Delhi. *Corresponding author e-mail: pravin.iari@gmail.com.

Table 1 Effect of different seed rates and nitrogen levels on fresh leaf, dry leaf weight and seed yield of *nagauri methi* (mean of two years 2014-15 and 2015-16)

Treatment	Fresh leaf weight cutting wise (kg/ha)					Total fresh leaf wt. (kg/ha)	Dry leaf wt. (kg/ha)	Seed yield (kg/ha)
	Ist	IInd	IIIrd	IVth	Vth			
Seed rate (kg/ha)								
50	5078	5427	7213	4757	5532	28007	3161	157
75	6042	6197	8091	5423	6131	31883	3645	179
100	6281	6258	8248	5571	6435	32794	3732	190
SEm ±	123	120	162	106	132	276	42	3.8
CD (P=0.05)	360	351	474	310	388	810	125	11.2
Nitrogen levels (kg/ha)								
0	5167	5424	7147	4681	5436	27854	3166	134
15	5674	5832	7714	5156	5851	30226	3456	171
30	6069	6223	8118	5461	6253	32125	3656	193
45	6292	6364	8422	5704	6592	33374	3772	202
SEm ±	142	138	187	122	153	319	49	4.4
CD (P=0.05)	415	406	547	358	448	936	144	12.9

methi with seed rate of 100 kg/ha recorded significantly higher dry leaf weight (3732 kg/ha) and seed yield (190 kg/ha) followed by 75 kg seed rate which recorded 3645 kg/ha dry leaf weight and 179 kg/ha seed yield and showed statistically at par with each other and showed superiority over 50 kg/ha seed rate. Sowing with 75 kg/ha seed rate produced 21.01 per cent higher seed yield over 50 kg/ha. The cutting favours the vegetative regrowth of *nagauri methi* (Godara *et al.* 2013) and according to the principles of asymptotic curve stated that vegetative growth of crop increase with increase in plant population per unit area results in higher biomass production on per unit area basis (Deora *et al.* 2009 and Reddy and Reddy 2010). As the dry weight of leaf and seed yield increased it resulted in higher profitability, i.e. gross return (₹ 416632/ha) and net return (₹ 315252/ha) recorded under the seed rate of 100 kg/ha followed by 75 kg/ha, which attained profitability in terms of gross return (₹ 405780/ha) and net return (₹ 310650/ha) that achieved better economic option with highest B:C ratio (4.27) from *nagauri methi.* This might be due to 25 kg/ha lower seed rate used in *nagauri methi* that curtailed cost of cultivation per ha basis.

Further data revealed that an average yield of fresh leaf during 2014–15 and 2015–16 under each cuttings increased significantly up to 3rd cutting (8422 and 8118 kg/ha), but it declined in 4th cutting (5704 and 5461 kg/ha) and then further regained at 5th cutting (6592 and 6253 kg/ha) under 45 kg N/ha and 30 kg N/ha, respectively (Table 1). Although, these treatments (45 and 30 kg N/ha) were equally effective in harvesting fresh leaf from the *nagauri methi*. Further, two year mean of five cuttings revealed that application of nitrogen 45 kg/ha significantly recorded

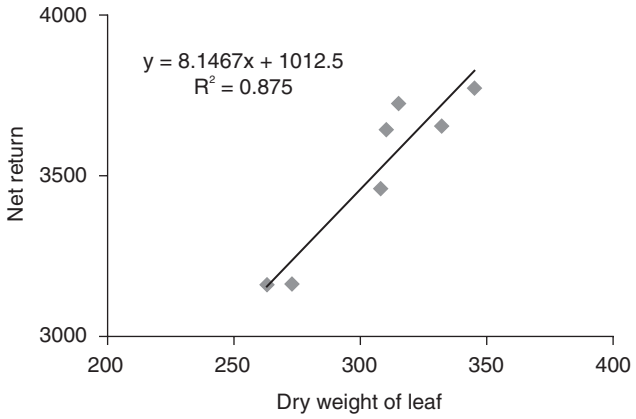

Fig 1 Regression analysis between dry weight of leaf (kg/ha) and net return (₹×1000/ha) of *nagauri methi.*

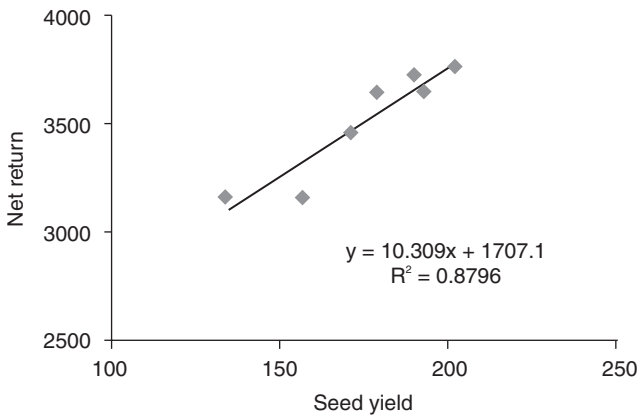

Fig 2 Regression analysis between seed yield (kg/ha) and net return (₹×1000/ha) of *nagauri methi.*

Table 2 Effect of different seed rates and nitrogen levels on economics of *nagauri methi* (mean of two years 2014-15 and 2015-16)

Treatment	Cost of cultivation (× 10^3 ₹/ ha)	Gross returns (× 10^3 ₹/ ha	Net returns (× 10^3 ₹/ ha	B:C ratio
Seed rate (kg/ha)				
50	88.88	351.99	263.11	3.96
75	95.13	405.78	310.65	4.27
100	101.38	416.63	315.25	4.11
Nitrogen levels (kg/ha)				
0	76.38	349.40	273.02	4.57
15	76.57	385.00	308.42	5.03
30	76.77	409.10	332.32	5.33
45	76.96	422.36	345.40	5.49

*Seed price @ 250/kg both the years, *Dry leaf sale price @ 110/kg 2015-16 and 100/kg 2014-15, *Seed sale price @ 150/kg 2015-16 and 130/kg 2014-15.

higher fresh leaf weight (33374 kg/ha), dry leaf weight (3772 kg/ha) and seed yield (202 kg/ha). This might be due to application of nitrogen increased vegetative growth by synthesizing more amino acids and chlorophyll in the leaf that provide more site to harvest maximum solar radiation which ultimately increase photosynthesis that results in higher photosynthates accumulation in leaf (Deora *et al.* 2009). However, these treatments were found statistically at par with each other, but showed significant superiority over 15 kg N/ha and control (0 kg N/ha). An increase in nitrogen would accommodate more leaf on the plant resulted in more leaf yield per unit area. These findings are also in conformity with the findings of Dhangrah *et al.* (2018). As increased in dry leaf weight and seed yield of *nagauri methi* fetched maximum profitability by application of 45 kg N/ha in terms of gross return (₹ 422360/ha), net return (₹ 345403/ha) and B: C ratio (5.49) followed by 30 kg N/ ha. However, the lowest B: C ratio (5.03 and 4.57) was associated with 15 kg N/ha and control, respectively.

The regression analysis proved that net return (₹/ha) and their interaction with dry leaf weight (kg/ha) and seed yield (kg/ha) of *nagauri methi* were positively correlated with co-efficient of determination (R^2) = 0.875 and R^2 = 0.8796, respectively. This was further supported by the regression analysis, which revealed that as unit weight of dry leaf and seed increases, the net return also increased by 8.147 (₹×1000/ha) and 10.309 (₹×1000 /ha), respectively in *nagauri methi* (Fig 1 and Fig 2). This finding is supported by Shukla *et al.* (2014).

SUMMARY

The study concluded that fresh weight of leaf (cutting wise), total fresh and dry weight of leaf, and seed yield and viable economic advantages in cultivation of *nagauri methi* were obtained significantly under the treatment combination of 100 kg/ha seed rate and 45 kg N/ha. It was further summarized that combination of 100 kg/ha seed rate and 45 kg N/ha had produced significantly higher quantity of dry leaf and seed yield as well as better monetary return in terms of gross return and net return resulted in higher B: C ratio under Arid Zone of Western Rajasthan.

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