



Economic feasibility of weed management practices in nigella (*Nigella sativa* L.)

S S Meena*, R S Mehta, R D Meena, R L Meena & D K Sharma

National Research Centre on Seed Spices,
Tabiji, Ajmer-305 206, Rajasthan.

*E-mail: ssmnrcss5@yahoo.com

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Abstract

A field experiment was conducted to find out the suitable and economical method of weed control in nigella. Based on two year study, it was found that besides weed free treatment, significantly higher plant height, number of primary and secondary branches, number of leaves, number of nodes and dry matter accumulation plant⁻¹ (at 60 days after sowing (DAS), 90 DAS and at harvest) were recorded with the pre-emergence application of oxadiargyl @ 75 g ha⁻¹ + one hand weeding at 45 DAS and pendimethalin @ 1 kg ha⁻¹ + one hand weeding at 45 DAS. Similarly, yield attributes like number of siliqua plant⁻¹, number of seeds siliqua⁻¹, siliqua size and test weight as well as seed and straw yields of nigella were also higher with these two treatments. Besides weed free treatment, lower dry weight of weed at harvest, weed index with highest weed control efficiency was obtained under pre-emergence (PE) application of oxadiargyl @ 75 g ha⁻¹ + one hand weeding at 45 DAS. The Highest gross returns and net returns were obtained in weed free treatment followed by effective control of weed with pre-emergence application of oxadiargyl @ 75 g ha⁻¹ + one hand weeding at 45 DAS but highest B: C ratio (2.62) was recorded with pre-emergence application of oxadiargyl @ 75 g ha⁻¹ + one hand weeding at 45 DAS.

Keywords: economics, herbicides, nigella, seed yield, weed, weed index

Introduction

Nigella (*Nigella sativa* L.) is a minor and annual herbaceous seed spice crop belonging to the family *Ranunculaceae*. It is widely cultivated throughout Southern Europe, Syria, Egypt, Saudi Arabia, Iran, Pakistan, India and Turkey (Riaz 1996). The seeds are known as black cumin. Mature seeds are consumed for edible and medical purposes. The seeds are also used in seasoning of vegetables, legumes and different type of baked products. Recent pharmacological investigations have proved

the potential therapeutic effects of nigella seed as well as its oil through various studies. Precise information on weed management in nigella is essential and inevitable for getting healthy growth of plants. Being a slow growing seed spice, more prone to crop weed competition. Initial slow growth of nigella leads to severe weed crop competition and reduces growth as well as yield by as high as 91.4% (Mali & Suwalka 1987). Manual weeding is commonly employed practice. But availability of labour is a problem, besides its high cost.

Since manual weeding is laborious and cost intensive, it is essential to find out an appropriate and economical method of weed control to keep nigella fields weed free at the critical stages of crop-weed competition. Pre-emergence application of herbicides may lead to cost effective control of the weeds right from the start which otherwise may not be possible by manual weeding. Keeping these in view the present study was carried out to evaluate the economic feasibility of weed management practices in nigella.

Materials and methods

The experiment was conducted on sandy loam soil of research farm of National Research Centre on Seed Spices, Ajmer (Rajasthan) India. Ten weed control treatments consisting of manual weeding at 30 & 60 days after sowing (DAS), pre-emergence application of oxadiargyl @75 g ha⁻¹ + one hand weeding at 45 DAS, post-emergence application of oxadiargyl @75 g ha⁻¹ at 20 DAS, post-emergence application of oxadiargyl @75 g ha⁻¹ at 20 DAS + one hand weeding at 50 DAS, pre-emergence and post-emergence application of oxadiargyl @75 g ha⁻¹ at 45 DAS, Pre-emergence application of pendimethalin @0.75 kg ha⁻¹, pre-emergence application of pendimethalin @0.75 kg ha⁻¹ + one hand weeding at 45 DAS, pre-emergence application of pendimethalin @0.75 kg ha⁻¹ + post emergence application of oxadiargyl @75 g ha⁻¹ at 45 DAS, weed free and weedy check treatments were applied in randomized block design with three replications during *rabi* season of 2010–11 and 2011–12. The soil of the experimental field was sandy loam having low organic matter (0.23%), available nitrogen (178.65 kg ha⁻¹) and phosphorus (12.0 kg ha⁻¹) and sufficient level of available potassium (165 kg ha⁻¹), with alkaline (pH 8.04). The nigella variety Ajmer Nigella-1 (AN-1) was sown on 15th October during both the years at the same site at 30 cm row to row and 10 cm plant to plant spacing with seed rate of 8 kg ha⁻¹. Irrigation was given immediately after sowing. All other standard cultural practices were followed during whole cropping period. Pre- and post- emergence application of oxadiargyl, and pendimethalin were applied with the help

of a Knapsack sprayer fitted with flat fan nozzle with a spray volume of 600 L ha⁻¹. In manual weed control treatments, weeds were uprooted and removed at 30 and 60 DAS as per treatments. In weed free plots, the weeds were removed manually after every seven days for ensuring complete weed free condition. After uprooting of weeds, the weeds were sun dried completely till it reached constant weight and finally the dry weight was recorded for each treatment and expressed as q ha⁻¹. Weed control efficiency and weed index were calculated by the formulae suggested by Kondap & Upadhyya (1985). Statistical analysis was done by the procedure described by Panse & Sukhatme (1985).

Results and discussion

Growth

Data presented in Table 1 revealed that weed control treatments significantly influenced various plant growth parameters. Beside, weed free treatment, higher plant height, number of leaves, number of nodes, primary branches, secondary branches, fresh weight and dry matter accumulation plant⁻¹ at all the growth stages were recorded with the pre- emergence application of oxadiargyl @75 g ha⁻¹ + one hand weeding at 45 DAS which was at par with pre-emergence application of pendimethalin @1 kg ha⁻¹ + one hand weeding at 45 DAS. The lowest values of all these parameters were recorded under weedy check. These results corroborated with those reported by Dungarwal *et al.* (2002) and Meena & Mehta (2009).

Yield attributes and yield

Yield attributes as well as seed and straw yields were significantly influenced with the application of different weed control treatments during both the years as well as in pooled analysis. Results revealed that after weed free treatments the highest yield attributes like earlier initiation of flowering and 50% flowering, maximum number of siliqua plant⁻¹ (17.67), number of seeds siliqua⁻¹ (83.83) and test weight (1.88 g) as well as seed yield (8.81 q ha⁻¹), straw yield (23.10 q ha⁻¹) and biological yield (32.10 q ha⁻¹) were recorded with the pre-

Table 1. Effect of weed management practices on growth parameters of nigella (pooled for two years)

Treatments	Plant height (cm)	No. of nodes plant ⁻¹	Fresh weight plant ⁻¹ (gm)	Dry weight plant ⁻¹ (gm)	No. of primary branches plant ⁻¹	No. of secondary branches plant ⁻¹	No. of leaves plant ⁻¹
Manual weeding at 30 & 60 DAS	42.22	13.0	60.18	28.23	9.6	15.67	52.6
Oxadiargyl @75 g ha ⁻¹ (PE) +HW at 45 DAS	46.7	14.5	69.68	32.1	10.27	18.33	59.67
Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 20 DAS	43.07	13.4	63.76	30.2	9.87	16.93	53.47
Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 20 DAS +HW at 50 DAS	44.78	14.0	68.88	31	9.97	18.13	57.4
Oxadiargyl @75 g ha ⁻¹ (PE) & Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 45 DAS	44.54	13.8	63.8	30.9	9.9	16.93	57.33
Pendimethalin @ 0.75 kg ha ⁻¹ (PE)	41.38	12.6	50.32	26.2	9.27	14.0	50.0
Pendimethalin @ 0.75 kg ha ⁻¹ (PE) +HW at 45DAS	42.72	13.1	63.25	29.8	9.63	15.97	52.67
Pendimethalin @ 0.75 kg ha ⁻¹ (PE)+ Oxadiargyl @ 75 g ha ⁻¹ (Pt.E) at 45DAS	41.6	12.8	55.02	27.36	9.6	15.6	51.6
Weed free	49.35	15.0	86.16	32.5	11.5	18.77	59.87
Weedy check	40.88	11.3	31.2	12.5	9.0	3.83	38.87
S.E.m±	1.66	0.5	2.17	1.11	0.53	0.73	1.95
CD (P<0.05)	4.92	1.5	6.46	3.29	1.57	2.18	5.8

DAS=Days after sowing; PE=Pre emergence; Pt.E=Post emergence; HW=Hand Weeding

emergence application of oxadiargyl @75 g ha⁻¹ + one hand weeding at 45 DAS, which was at par with pre-emergence application of pendimethalin @1 kg ha⁻¹ + one hand weeding at 45 DAS. The lowest values of yield attributes and yields were recorded in weedy check (Table 2). Yadav *et al.* (2004) reported that application of oxadiargyl 50 g ha⁻¹ produced higher seed yield of cumin which was statistically at par with pendimethalin at 1.0 kg ha⁻¹. The results are in accordance with those of Rathore *et al.* (1990), Patel *et al.* (2004) and Meena & Mehta (2009).

Weed parameters

The most important weed flora in the experimental field throughout the growing period were *Chenopodium murale*, *Chenopodium album*, *Amaranthus viridis*, *Cyperus rotundus*, *Phalaris minor*, *Cynodon dactylon* and *Anagallis arvensis*, respectively. Application of different treatments significantly affected dry weight of weeds, weed control efficiency and weed index. Besides weed free treatment, the lowest dry weight of weed (3.97 q ha⁻¹) and weed index (7.6%) at harvest and highest weed control efficiency (95.48%) were recorded with pre-emergence application of oxadiargyl @75 g ha⁻¹ + one hand weeding at 45 DAS. The higher weed control efficiency, lower weed index and dry weight of weeds under pre-emergence application of oxadiargyl @75 g ha⁻¹ + one hand weeding at 45 DAS was due to effective control of weeds from the field and manual removal of weeds that escaped from herbicide treatment at 45 DAS. The combined effect of herbicide and hand weeding at 45 DAS resulted in remarkably lesser dry weight of weeds (Table 3). These findings are akin to the report of Patel *et al.* (2004) and Meena & Mehta (2009).

Economics

Gross return, net return and B:C ratio were significantly influenced by the application of different weed control treatments. The highest gross return of Rs. 87,950 ha⁻¹ was obtained in weed free treatment followed by pre-emergence application of oxadiargyl @75 g ha⁻¹ + one hand weeding at 45 DAS (Rs. 83,910 ha⁻¹). However, the highest net return (Rs. 60,727 ha⁻¹) and B:C

Table 2. Effect of weed management practices on yield attributes and yield of nigella (pooled for two years)

Treatments	No. of siliqua plant ⁻¹	No. of seeds siliqua ⁻¹	Seed yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)	Biological yield (q ha ⁻¹)	Test Weight (g)
Manual weeding at 30 & 60 DAS	13.80	76.93	6.83	21.89	28.20	1.72
Oxadiargyl @75 g ha ⁻¹ (PE) + HW at 45 DAS	17.67	83.83	8.81	23.1	32.10	1.88
Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 20 DAS	15.00	78.33	6.44	22.1	29.00	1.76
Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 20 DAS + HW at 50 DAS	17.07	80.27	7.79	22.9	30.40	1.80
Oxadiargyl @75 g ha ⁻¹ (PE) & Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 45 DAS	15.27	79.27	7.49	22.65	31.00	1.78
Pendimethalin @0.75 kg ha ⁻¹ (PE)	11.33	70.40	6.0	20.5	26.90	1.48
Pendimethalin @0.75 kg ha ⁻¹ (PE) + HW at 45 DAS	14.13	77.07	6.98	22.0	28.45	1.75
Pendimethalin @0.75 kg ha ⁻¹ (PE) + Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 45 DAS	12.53	75.53	6.03	21.69	27.80	1.49
Weed free	20.07	85.47	9.84	23.5	32.50	2.00
Weedy check	2.60	47.07	2.84	15.7	19.75	1.46
S.Em±	0.60	3.34	0.28	0.96	1.18	0.06
CD (P<0.05)	1.78	9.94	0.83	2.85	3.50	0.18

Table 3. Effect of weed management practices on weed control efficiency, weed index and dry weight of weeds, gross return, net return and B:C ratio (pooled for two years)

Treatments	Dry weight of weeds at harvest q ha ⁻¹	Weed control efficiency (%)	Weed index (%)	Gross return Rs. ha ⁻¹	Net return Rs. ha ⁻¹	B:C
Manual weeding at 30 & 60 DAS	10.09	88.57	28.56	65848	39066	1.46
Oxadiargyl @75 g ha ⁻¹ (PE) + HW at 45 DAS	3.97	95.48	7.16	83910	60728	2.62
Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 20 DAS	7.39	91.57	21.31	62380	42198	2.09
Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 20 DAS + HW at 50 DAS	5.14	94.28	9.66	74690	51508	2.22
Oxadiargyl @75 g ha ⁻¹ (PE) & Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 45 DAS	6.03	93.08	17.42	71940	50858	2.41
Pendimethalin @0.75 kg ha ⁻¹ (PE)	8.99	89.97	21.98	58100	37755	1.86
Pendimethalin @0.75 kg ha ⁻¹ (PE) + HW at 45 DAS	9.25	90.06	29.07	67220	43875	1.88
Pendimethalin @0.75 kg ha ⁻¹ (PE) + Oxadiargyl @75 g ha ⁻¹ (Pt.E) at 45 DAS	12.21	86.38	33.52	58608	37363	1.76
Weed free	0.00	100.00	0.00	87950	58168	1.95
Weedy check	93.20	0.00	54.43	28700	9418	0.49
S.Em±	2.06	3.23	1.22			
CD (P<0.05)	6.13	9.58	3.61			

Selling price of nigella seed Rs. 9200 q⁻¹

ratio (2.62) was recorded with the application of oxadiargyl @75 g ha⁻¹ (PE) + one hand weeding at 45 DAS. Hence, it is inferred from the investigation that the pre- emergence application of oxadiargyl @75 g ha⁻¹ + one hand weeding at 45 DAS is the best economically feasible treatment resulting in efficient weed control and higher yields.

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