International J. Seed Spices 9(2), July 2019:86-90

Economic appreciation in *Nigella sativa* L. via effective weed management strategies

S.S. Meena, G. Lal, P.N. Dubey, P. K. Agrawal and D.K. Sharma

ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer-305 206, India

Abstract

Nigella sativa L. is an annual herbaceous seed spice crop belonging to the family Ranunculaceae. It is widely cultivated throughout South Europe, Syria, Egypt, Saudi Arabia, Iran, Pakistan, India and Turkey. The nigella seeds are also known as black cumin. It has been used as herbal medicine for more than 2000 years. As seed spice, it is also used as food additive and flavour in many countries. Considering its economic and medicinal importance a field experiment was conducted during rabi crop season of 2012-13 and 2013-14 at ICAR - NRCSS research farm, Ajmer (Rajasthan), India to evaluate suitable and economical methods of weed management & its effect on yield attributes of nigella. The experiment was laid in randomized block design with 10 treatments including control and three replications each. Results of the two year data revealed that after weed free treatments (T_1) the highest yield attributes like 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}) and straw yield (23.10 q ha^{-1}) were recorded with the pre- emergence application of oxadiargyl @ 75 g + one hand weeding at 45 DAS (T_2), followed by post emergence (Pt.E) application of oxadiargyl @ 75 g at 20 DAS + one hand weeding at 50 DAS (T_4). The lowest values of yield attributes and yields were recorded in weedy check (T_4). The highest gross returns and net returns per ha was obtained in weed free treatment (T_1) followed by effective weed control with oxadiargyl (T_2) after sowing, the highest B: C ratio (2.62) was recorded with pre-emergence application of oxadiargyl (T_2).

Key words : Herbicides, nigella, seed yield, yield attributes.

Introduction

Nigella (*Nigella sativa* L.) is an annual herbaceous seed spice crop belonging to the family Ranunculaceae. It is widely cultivated throughout South Europe, Syria, Egypt, Saudi Arabia, Iran, Pakistan, India and Turkey (Riaz, 1996). The seeds are also known as black cumin. It has been used as herbal medicine for more than 2000 years. As seed spice, it is also used as food additive and flavour in many countries. Mature seeds are consumed for edible and medical purposes and also used in seasoning of vegetables, legumes and different type of baked products. The essential oil of nigella has been found to contain about 67 constituents, many of which are capable of inducing beneficial pharmacological effects in humans. Its seeds contain thymoquinone and monoterpenes, having variety of therapeutic effects on digestive disorder, gynecological disease and respiratory system (Boskkbady & Shahabi 1997; Lal and Meena 2018; Dubey *et al.,* 2016). Nigella has been extensively in use for centuries in folk medicines, both as herb and for oil, by people in Asia, Middle East and Africa. Seeds are used as a new source of edible oils and food applications as spice and condiments in cakes, breads, pastries, curries, pickles and in seasoning etc. Among Muslims, it is regarded as one of the greatest forms of healing medicine available on earth. In the Greco Arab/Unani Tibb system of medicine, black seed has been regarded as a valuable remedy in hepatic and digestive disorders and has been described as a stimulant in a variety of conditions, ascribed to an imbalance of cold. 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 its more prone to crop weed competition. Initial slow growth of nigella leads to severe weed crop competition and reduces growth as well as yield up to 91.4 per cent. Manual weeding is the traditional practice employed. Though availability of labour itself is a problem, besides of its high cost. Since manual weeding is laborious and cost intensive, it become pertinent 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 so as to procure

*Corresponding author email: ssmnrcss5@yahoo.com

best harvest . Pre-emergence application of herbicides may lead to cost effective control of the weeds right from the beginning which otherwise may not be possible by manual weeding. Keeping in view the above mentioned facts, present study was carried out to evaluate economic feasibility of weed management practices in nigella and vis-s-vis improvement in quality attributes.

Materials and methods

The experiment on effect of weed management practices on yield and quality aspects of nigella was conducted on sandy loam soil taxonomically placed as coarse loamy Typic Haplustept at research farm of ICAR-NRCSS, Ajmer (Rajasthan) India. Ten weed control treatments consisting of manual weeding at 30 & 60 DAS (T_1), pre-emergence application of oxadiargyl @ 75 g ha^{-1} + one hand weeding at 45 DAS (T_2), post-emergence (Pt.E) application of oxadiargyl @ 75 g ha^{-1} at 20 DAS (T_3), post-emergence application of oxadiargyl @ 75 g ha^{-1} at 20 DAS + one hand weeding at 50 DAS (T_4), pre-emergence and post-emergence application of oxadiargyl @ 75 g ha^{-1} at 45 DAS (T_5), pre-emergence application of pendimethalin @ 0.75 kg ha^{-1} (T_6), pre-emergence application of pendimethalin @ 0.75 kg ha^{-1} + one hand weeding at 45 DAS (T_7), pre-emergence application of pendimethalin @ 0.75 kg ha^{-1} + post emergence application of oxadiargyl @ 75 g ha^{-1} at 45 DAS (T_8), weed free (T_9) and weedy check treatments (T_{10}) were applied in randomized block design with three replications during *rabi* season of 2012-13 and 2013-14. The soil of the experimental field was sandy loam containing low organic matter (0.23 %), available nitrogen (178.65 kg ha^{-1}) and phosphorus (12.0 kg ha^{-1}) and sufficiently available potassium (165 kg ha^{-1}), slightly alkaline (pH 8.04 and EC0.076 dS m^{-1}). The nigella variety Ajmer Nigella-1was sown on 15th October during both the years at the same site with 30 cm row to row and 10 cm plant to plant spacing with seed rate of 8 kg ha^{-1}. Irrigation was provided immediately after sowing. All other standard cultural practices were followed during entire cropping period. Pre and post emergence application of oxadiargyl and pendimethalin were carried out with the help of a Knapsack sprayer fitted with flat fan nozzle with a spray volume of 600 liters 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 & Upadhya (1985). Statistical analysis was done by the procedure prescribed by Panse & Sukhatme (1985).

Results and discussion

Weed parameters

The most important weed flora in the experimental field throughout the growing period were *Chenopodium murale*, *Chenopodium album*, *Amaranthus virdis*, *Cyperus rotundus*, *Phalaris minor*, *Cynadon 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 + one hand weeding at 45 DAS (T_2). The higher weed control efficiency, lower weed index and dry weight of weeds under pre- emergence application of oxadiargyl @ 75 g + one hand weeding at 45 DAS (T_2) was due to effective control of weeds from the field and weeds those escaped from herbicidal control were removed by hand weeding at 45 DAS (T_2). The combined effect of herbicide and hand weeding at 45 DAS (T_2) resulted in remarkably lesser dry weight of weeds (Table 2). These findings are akin to the report of Patel *et al.* (2004) and Meena & Mehta (2009).

Yield attributes

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 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}) and straw yield (23.10 q ha^{-1}) were recorded with the pre- emergence application of oxadiargyl @ 75 g + one hand weeding at 45 DAS (T_2), followed by post emergence application of oxadiargyl @ 75 g at 20 DAS + one hand weeding at 50 DAS (T_4). The lowest values of yield attributes and yields were recorded in weedy check (Table1). The results are in accordance with those of Rathore *et al.* (1990), Patel *et al.* (2004) and Meena & Mehta (2009).

Economical studies

Gross return, net return and B: C ratio were significantly influenced by the application of different weed control treatments. The highest Gross return of ₹ 87950 ha^{-1}

Table 2. Effect of weed management practices on weed control efficiency, weed index and dry weight of weeds as well as gross return, net return and B: C ratio (pooled data for two year).

Treatments	Dry weight of weeds at harvest q ha^{-1}	Weed control efficiency (%)	Weed index (%)	Gross return ₹ ha^{-1}	Net return ₹ ha^{-1}	B:C
Manual weeding at 30 & 60 DAS (T_1)	10.09	88.57	28.56	65848	39066	1.46
Oxadiargyl @75g ha^{-1} (PE) +HW at 45 DAS (T_2)	3.97	95.48	7.16	83910	60728	2.62
Oxadiargyl @75g ha^{-1} (Pt.E) at 20DAS (T_3)	7.39	91.57	21.31	62380	42198	2.09
Oxadiargyl @75g ha^{-1} (Pt.E) at 20DAS +HW at 50DAS (T_4)	5.14	94.28	9.66	74690	51508	2.22
Oxadiargyl @75g ha^{-1} (PE) & Oxadiargyl @75g ha^{-1} (Pt.E) at 45DAS (T_5)	6.03	93.08	17.42	71940	50858	2.41
Pendimethalin @0.75kg ha^{-1} (PE) (T_6)	8.99	89.97	21.98	58100	37755	1.86
Pendimethalin @0.75kg ha^{-1} (PE) +HW at 45DAS (T_7)	9.25	90.06	29.07	67220	43875	1.88
Pendimethalin @0.75kg ha^{-1} (PE)+ Oxadiargyl @75g ha^{-1} (Pt.E) at 45DAS (T_8)	12.21	86.38	33.52	58608	37363	1.76
Weed free (T_9)	0.00	100.00	0.00	87950	58168	1.95
Weedy check (T_{10})	93.20	0.00	54.43	28700	9418	0.49
S.Em±	**2.06**	**3.23**	**1.22**			
CD at 5%	**6.13**	**9.58**	**3.61**			

Selling price of nigella seed ₹ 9200 q^{-1}

Table 1. Effect of weed management practices on yield attributes and yield (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})	Test Weight (gm)
Manual weeding at 30 & 60 DAS (T_1)	13.80	76.93	6.83	21.89	1.72
Oxadiargyl @ 75g ha^{-1} (PE) +HW at 45 DAS (T_2)	17.67	83.83	8.81	23.1	1.88
Oxadiargyl @ 75g ha^{-1} (Pt.E) at 20DAS (T_3)	15.00	78.33	6.44	22.1	1.76
Oxadiargyl @ 75g ha^{-1} (Pt.E) at 20DAS +HW at 50DAS (T_4)	17.07	80.27	7.79	22.9	1.80
Oxadiargyl @ 75g ha^{-1} (PE) & Oxadiargyl @ 75g ha^{-1} (Pt.E) at 45DAS (T_5)	15.27	79.27	7.49	22.65	1.78
Pendimethalin @ 0.75kg ha^{-1} (PE) (T_6)	11.33	70.40	6.0	20.5	1.48
Pendimethalin @ 0.75kg ha^{-1} (PE) +HW at 45DAS (T_7)	14.13	77.07	6.98	22.0	1.75
Pendimethalin @ 0.75kg ha^{-1} (PE)– Oxadiargyl @ 75g ha^{-1} (Pt.E) at 45DAS (T_8)	12.53	75.53	6.03	21.69	1.49
Weed free (T_9)	20.07	85.47	9.84	23.5	2.00
Weedy check (T_{10})	2.60	47.07	2.84	15.7	1.46
S.Em±	0.60	3.34	0.28	0.96	0.06
CD at 5 %	1.78	9.94	0.83	2.85	0.18

was obtained in weed free treatment (T_9) followed by pre-emergence application of oxadiargyl @ 75 g ha^{-1} + one hand weeding at 45 DAS (T_2) (₹ 83910 ha^{-1}).However, the highest net return (₹ 60727 ha^{-1}) and B:C 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 weed control treatment resulting in efficient weed and ultimately higher yields. 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}.

Conclusions

In view of the results obtained from present study it can be concluded that weed control through application of oxadiragyl @ 75g ha^{-1} + HW at 45 DAS (T_2) was efficient with respect to higher net return (₹ 60728/ha^{-1}), BCR (2.62) and appreciation in yield attributes as compared to weed free treatment (T_9). Efficient weed control through rationalized use of weedicides is an effective means to ensure yield and economic appreciation.

References

Boskabady, M. H. and Shahabi, M. 1997. Bronchodilatatory and anticholinergic effects of *Nigella sativa* on isolated guinea pig tracheal chains. *Iranian J.Med.Sci*., 22:133-136.

Dubey, P. N., Singh, B., Mishra, B. K., Kant, K., and Solanki, R. K. 2016. Nigella (*Nigella sativa*): a high value seed spice with immense medicinal potential. *Indian J. Agric. Science*. 86 (8):967-979.

Kondap, S. M., Upadhya, U. C. 1985. A practical manual on weed control, Oxford and IBH Pub. Co., New Delhi, P.55.

Lal, G. and Meena, S. S. 2018. Medicinal and Therapeutic Potential of Seed Spices. *Biomedical J. Scintific and Technical Research,* 5(4) :1-21.

Meena, S. S. and Mehta, R. S. 2009. Economic feasibility of weed management practices in cumin (*Cuminum cyminum* L.). *Indian J. Hort*., 67(Sp.I.):189-192.

Panse, V. G. and Sukhatme, P. V. 1985. Statistical methods for Agricultural workers, Fourth Enlarged Edition, ICAR Pub. New Delhi.

Patel, R. H., Shroff, Jagruti, Usadadia, V. P., Shah, S. N. 2004. Influence of nitrogen and weed management practices on weeds and coriander. *Indian J. Weed Sci.*, 36 (1&2): 86-88.

Rathore, P. S., Bhati, D. S., Mali, A. L. 1990. Effect of weed control measures on growth and yield of cumin. *Indian J. Agron*. 35 (3): 304-305.

Riaz, M., Syed, M. and Chaudhary, F. M. 1996. Chemistry of the medicinal plants of the genus Nigella.Hamdard Medicus, 39:40-5.

Yadav, R. S., Sharma, S. K., Poonia, B. L. and Dhama, A. K. 2004. Selectivity and phytotoxicity of Oxadiargyl on cumin and weeds and its residual effect on succeeding moth bean and pearl millet. *Indian J. Weed Sci*. 36 (1&2): 83-85.

Received : April 2019; Revised : June 2019; Accepted : June 2019.