Int.J.Curr.Microbiol.App.Sci (2018) *7*(9): 1156-1167

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 09 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.709.137

Influence of Different Dates of Sowing, Fertilizer Level and Weedicides on Growth and Yield of Nigella (*Nigella sativa* L.) under Semi-Arid Conditions

Ved Kant, S.S. Meena, N.K. Meena* and G. Lal

ICAR-National Research Centre on Seed Spices, Ajmer (Rajasthan), India

**Corresponding author*

Keywords

Sowing dates, Fertilizer doses, Weedicides, *Nigella sativa* L., Semi-arid region

Article Info

Accepted:
08 August 2018
Available Online:
10 September 2018

A B S T R A C T

An investigation was carried out at ICAR-National Research Centre on Seed Spices, Ajmer, Rajasthan during *Rabi* season 2016-17 to ascertain the suitable sowing date, fertilizers doses and weedicide for quality production of nigella variety AN-1. Result illustrated that significantly higher plant height (44.0 cm), per plant primary branches (6.6), secondary branches (8.5), days taken to 50% flowering (77.9), seed yield (778.8 kg ha^{-1}), straw yield (1484.0 kg/ha) and biological yield (2262.9 kg ha^{-1}) were recorded in 1st November sown nigella crop over crop sown on 15th and 30th November. Irrespective of sowing dates, the maximum plant height (44.9 cm), per plant primary branches (6.0), secondary branches (7.4), days taken to 50% flowering (74.8), seed yield (677.2 kg ha^{-1}), straw yield (1367.2 kg/ha) and biological yield (2044.4 kg ha^{-1}) were recorded under the application of NPK level (F_2) 40:40:20 kg ha^{-1}. The pre-emergence application of oxadiargyl @ 75g a.i. ha^{-1} provided more plant height (43.0cm), per plant primary branches (5.9), secondary branches (7.1), days taken to 50% flowering (68.0), weed counts (18.0 and 24.3 weeds/m^2 area) at 30 and 60 DAS, respectively, seed yield (633.5 kg ha^{-1}), straw yield (1386.1) and biological yield (2019.7 kg ha^{-1}). On the basis of cumulative effect of the treatment combinations, $D_1xF_2xW_2$ given maximum plant height (46.4 cm), number of primary and secondary branches (7.2 and 10.3), siliqua per plant (18.9), whereas maximum seed yield (922.2 kg ha^{-1}), gross return (Rs.167440 ha^{-1}), net return (Rs. 122900 ha^{-1}) and BCR (3.76) were recorded in treatment combination D_1 x F_3 x W_1.

Introduction

Nigella (*Nigella sativa* L.) is an annual herbaceous seed spice crop, belongs to family *Ranunculaceae*. It is native of Mediterranean and Western Asia regions. It is diploid species with chromosome no. 2n= 12. It is commonly known as *Kalonji* or black cumin. It is widely cultivated throughout South Europe, Syria, Egypt, Saudi Arabia, Iran, Pakistan, India and Turkey (Riaz *et al.*, 1996). In India, it is cultivated in Rajasthan, Uttar Pradesh, West Bengal, Punjab, Himachal Pradesh, Jharkhand, Madhya Pradesh, Andhra Pradesh and Assam. In India nigella is cultivating in 4.29 lakh hectare area, producing 1.72 lakh tonnes of seed with an average productivity of 402 kg ha^{-1} (Goswami, 2011). It is mainly growing during winter season. The seeds of nigella used as spices for making pickles, cooked vegetables and other cuisines. It can also be used in culinary, confectionary, perfumery,

cosmetics and pharmaceutical industry. Dried nigella seeds have several medicinal properties. It uses for remedies of various ailments *viz*., bronchitis, diarrhea, rheumatism, asthma and skin disorders (Sultana *et al.,* 2015), antifungal (Bita *et al.,* 2012), antioxidant and antiarthritic (Umar *et al.,* 2012), Gastro-protective (El-Abhar *et al.,* 2003), anticancer (Mbarek *et al.,* 2007), antidiabetic (Zaoui *et al.,* 2002) and also contain contraceptive and anti-fertility activity (Keshri *et al.,* 1995). It is also useful in digestive disorders, to increase milk production in nursing mothers to strengthen immune system and fight parasitic against infections (Al-Ali *et al.,* 2008). Roasted black seeds can be used as anti-vomiting (Morsi, 2000). The principle active ingredient of black seed is thymoquinone which can be isolated from volatile oil.

Growth and seed yield of nigella are largely influenced by the nutrient fertility status of the soil apart from genetic potential of the variety. Altering the soil nutrients and fertility status by providing balanced and adequate major nutrients like nitrogen, phosphorus and potassium as per the crop requirement is one of the easiest way to boost up seed crop productivity. Application of fertilizers, especially nitrogen and phosphorus had a considerable effect not only on quantity but also on the quality of the grain in many crops including nigella. It is well known that among yield influencing factors, date of sowing is equally important and said to be a major factor which directly influence the growth, yield and quality. Black cumin is a long day plant (Mollafilabi *et al.,* 2009) and interaction with the sowing time is crucial in the success of the crop. Likewise, weed population is another important factor responsible for declining the crop production. Simultaneous emergence and rapid growth of weed leads to severe weed-crop competition for nutrients, moisture, space and light. It has been reported that weed competition through growth periods would decrease black seed yield by 69% (Hussain *et al.,* 2009). Pre-emergence application of weedicides i.e. oxadiargyl @ 75 g a.i/ha or pendimethalin @ 1 kg/ha or oxadiargyl @ 0.075 kg/ha just after sowing + one hand weeding at 45 DAS gives higher yield (Meena *et al.,* 2009). Now black cumin is widely produced around the study area and the farmers are benefitting a lot from local market by selling seed yield (Melkie *et al.,* 2008). Moreover, till today there is very little information available pertaining to agronomic practices including suitable date of sowing, optimum dose of nitrogen, phosphorous and potassium fertilizers, weed management practices etc. Keeping these in view, this research was conducted to find out the suitable date of sowing, fertilizer doses (NPK levels) and weedicides for maximum growth and yield of nigella.

Materials and Methods

The field experiment entitled studies on effect of different sowing dates, NPK levels and weedicides on the growth and yield of nigella (*Nigella sativa* L.) was conducted during the *Rabi* season of 2016-17 at ICAR-NRC on Seed Spices, Ajmer. The site experiment was located between 74° 38’ 0” E longitude and 26° 27’ 0’’ N latitude and 460 m altitude from mean sea level (Meena *et al.,* 2017). The location is surrounded by Aravalli hills, provide 300-550 mm annual average rainfall, 2-5° Celsius temperature in the month of January and 42-45° Celsius in the month of May-June and relative humidity 60-80% during the period of study. The nutrient status of soil of research farm is sandy loam having pH 8 to 8.3 and 0.15 to 0.23% organic carbon, available N 178.5 kg ha^{-1} (low), P_2O_5 12 kg ha^{-1} (medium), K_2O 85 kg ha^{-1} (low). The treatments consisted of three dates of sowing (D_1-1st November, D_2-15th November and D_3-30th November), three doses of fertilizers NPK

levels (F_1-30:30:15 kg/ha, F_2-40:40:20 kg/ha and F_3-50:50:25 kg/ha) and two weedicides (W_1-pendimethalin @ 1 kg/ha and W_2-oxadiargyl @ 0.75 kg a.i./ha). The experiment was laid out in Randomized Block Design (RBD) with factorial concept. Eighteen treatment combinations were applied in three replications. The nigella variety AN-1 was sown in standard crop geometry as accordance to package of practices adopted by ICAR-NRCSS. Full dose of phosphorus, potash and half dose of nitrogen were given as basal dose at the time of soil preparation for sowing. The remaining nitrogen was applied in two equivalent split doses as top dressing in standing crop in at 30 and 60 days after sowing (DAS). The NPK were applied in the form of fertilizer urea, di-ammonium phosphate (DAP) and murate of potash (MOP). The pre-calculated quantities of weedicides i.e. pendimethalin @ 1.0 kg/ha and oxadiargyl @ 0.75 kg a.i. /ha were applied with the help of knapsack sprayer just after sowing as pre-emergence weedicide.

Data collection and statistical analysis

Observations on plant height (cm) were recorded from five randomly selected and tagged plants/plot at 45, 60, 90 DAS and at harvest measuring base of plant to tip of the main shoot. The numbers of primary and secondary branches per plant were recorded at 60, 90 DAS and at harvest. Numbers of green leaves/plant and fresh weight of green leaves (g) were recorded at 60 and 90 DAS, whereas, number of weeds per m^2 area and their fresh (g) and dry weight (g) at 30 and 60 DAS along with days taken to 50 per cent flowering were recorded. The yield attributes *viz*., number of siliqua per plant, number of seeds per siliqua, siliqua size (cm), test weight (g), seed yield, straw yield and biological yield in kg/ha and harvest index (%) were recorded. All the data related to the growth parameters and yield and yield attributes were obtained and statistically analyzed using OPSTAT software developed by CCSHAU, Hisar (India).

Results and Discussion

Growth parameters

The data on different growth parameters like plant height (cm), number of primary and secondary branches per plant, number of number of green leaves per plant at two different growth stages 60, 90 DAS and at harvest, fresh weight of green leaves/plant in g and days taken to 50% flowering was recorded and presented in Table 1. It was found that, the variation in growth parameters at different growth stages was recorded in different date of sowing, various doses of fertilizers and different weedicides application.

The maximum plant height at 60 DAS (15.0 cm), 90 DAS (40.8 cm) and harvest (44.0 cm), more number of primary branches per plant at 60 DAS (5.4), 90 DAS (6.6) and at harvest (6.6), per plant higher number of secondary branches at 60, 90 DAS and at harvest (5.3, 6.8 and 8.5, respectively), higher number of green leaves at 60 and 90 DAS (11.2 and 32.9) and higher fresh weight of green leaves at 60 and 90 DAS (3.2 g and 2.4 g) as well as days taken to 50 per cent flowering (77.9) were obtained when nigella crop sown on 1st November followed by crop sown on 15th November and 30th November. Similar findings were also observed by Haq *et al.*, (2015), Shadia *et al.*, (1998) in nigella, Sharangi and Roychowdhury (2014) and Naghera *et al.*, (2000) in coriander are accordance with the present findings.

Amongst three fertilizer doses, utmost plant height (44.9 cm), number of primary branches/plant (6.0), secondary branches/plant (7.4), number of green leaves/plant (31.0) and days taken to 50 per cent flowering (74.8) were recorded under fertilizers dose of

40:40:20 kg NPK per ha (F_2) which was recorded significantly superior over fertilizers doses 30:30:15 and 50:50:25 kg NPK per ha. These findings are in close conformity with the findings of Nataraja *et al.,* (2003) in nigella and Channabasavanna *et al.,* (2002) in coriander. Similarly, different weedicides applications were also significantly influenced the various growth attributes *viz*., maximum plant height (43.0 cm), number primary branches/plant (5.9), number of secondary branches/ plant (7.1), number of green leaves (29.9), their fresh weight (2.2 g) were recorded with the pre-emergence application of oxadiargyl @ 0.75 kg a.i/ha over pre-emergence application of pendimethalin @ 1 kg/ha. Meena *et al.,* (2014) also recorded the similar results with the application of oxadiargyl @ 0.75 kg a.i./ha (pre-emergence) in nigella, Meena *et al.,* (2009) and Meena and Mehta (2007) in coriander get support to the present finding.

Similarly, the pre-emergence application oxadiargyl @ 0.75 kg a.i./ha was found better weedicide, in which minimum number of weeds per m^2 area (18.0 and 24.3) and their fresh (10.9 and 130.1 g) and dry weight (1.4 and 21.5 g/m^2 area) were recorded at 30 and 60 DAS, respectively over pre-emergence application of Pendimethalin @ 1.0 kg/ha, wherein total number of weeds per m^2 area (70.1 and 72.9 at 30 and 60 DAS, respectively) (Table 3). These observations are quite in line with those of Meena *et al.,* (2014) in nigella, Patel *et al.,* (2016) and Yadav *et al.,* (2010) in cumin.

The cumulative data of different treatment combinations i.e. sowing dates, NPK levels and weedicides on various growth parameters of nigella are presented in Table 4, showed that the treatments combination of $D_1xF_2xW_2$ was given 72.33 cm highest average plant height, number of primary branches/plant (7.2) and number of secondary branches per plant (10.3), whereas, the minimum number of weeds count per m^2 area (1.0) was recorded $D_3xF_3xW_2$ treatments combination.

Yield parameters and yield

The data on various yield attributes and yield of black cumin were shown in Table 2, revealed that, maximum Siliqua per plant (16.1), seed per siliqua (71.1) and siliqua size (0.89 cm) and highest seed yield (778.8 kg/ha), straw yield (1484.0 kg/ha) biological yield (2262.9 kg/ha) and harvest index (36.2 %) were also recorded in crop sown on 1st November followed by 30th November and 15th November sown crop. Significant improvements in yield attributes of nigella were found in 1st November sown crops is in close agreement with findings of Haq *et al.,* (2015) and Shadia *et al.,* (1998) in nigella and Sharangi and Roychowdhury (2014) in coriander. Yield parameters were also influenced significantly by the different NPK levels. Maximum siliqua per plant (15.7), seed per siliqua (72.6) and siliqua size (0.88 cm) and maximum seed yield (677.2 kg/ha), straw yield (1367.2 kg/ha), biological yield (2044.4 kg/ha) and harvest index (33.5%) were recorded with the application of NPK level of 40:40:20 kg/ha (Table 2). These findings are in close conformity with the findings of Nataraja *et al.,* (2003) in *Nigella sativa,* Channabasavanna *et al.,* (2008) in ajwain and Bhat and Sulikeri (1992) in coriander. Yield parameters like siliqua per plant, seed per siliqua, seed yield, straw yield and biological yield were significantly affected by the application different weedicides. Maximum siliqua per plant (15.8), seed per siliqua (71.9), seed yield (633.5 kg/ha), straw yield (1386.1 kg/ha) and biological yield (2019.7 kg/ha) were observed with the application of oxadiargyl @ 0.75 kg a.i/ha. Meena *et al.,* (2014) in nigella and Yadav *et al.,* (2004) in cumin also found similar results get support to the present studies.

Table.1 Effect of sowing dates, NPK levels and weedicides on growth parameters at different growth stages of nigella

Treatments	Plant height (cm)				No. of Primary branches/Plant			No. of Secondary branches/Plant			No. of green leaves/Plant		Fresh Wt.(g) of green leaves/Plant		Days to 50% flowering
	45 DAS	60 DAS	90 DAS	At harvest	60 DAS	90 DAS	At harvest	60 DAS	90 DAS	At harvest	60 DAS	90 DAS	60 DAS	90 DAS	
Sowing dates															
D_1-1st November	7.9	15.0	40.8	44.0	5.4	6.6	6.6	5.3	6.8	8.5	11.2	32.9	3.2	2.4	77.9
D_2-15th November	6.1	11.7	39.3	43.2	5.2	5.7	6.0	4.5	6.4	6.6	9.5	24.4	0.5	1.9	75.1
D_3-30th November	6.6	11.9	35.9	40.0	3.2	4.2	4.5	2.2	4.9	5.5	9.3	26.5	1.0	1.6	71.1
S.Em±	0.36	0.18	0.33	1.30	0.24	0.24	0.24	0.17	0.20	0.51	0.16	0.74	0.09	0.11	0.18
CD (p=0.05)	1.04	0.54	0.97	NS	0.71	0.70	0.69	0.50	0.58	1.48	0.47	2.14	0.27	0.33	0.53
NPK levels															
F_1-30:30:15 kg/ha	6.3	11.7	35.5	40.4	3.9	4.7	5.1	3.1	4.6	5.9	9.4	23.6	1.3	1.8	74.7
F_2-40:40:20 kg/ha	7.2	13.5	41.6	44.9	4.6	5.8	6.0	4.2	6.6	7.4	10.2	31.0	1.9	1.9	74.8
F_3-50:50:25 kg/ha	7.0	13.4	38.9	41.8	5.2	6.0	6.0	4.7	7.0	7.4	10.4	29.2	1.5	2.1	74.6
S.Em±	0.36	0.18	0.33	1.30	0.24	0.24	0.24	0.17	0.20	0.51	0.16	0.74	0.09	0.11	0.18
CD (p=0.05)	NS	0.54	0.97	NS	0.71	0.70	0.69	0.50	0.58	NS	0.47	2.14	0.27	NS	NS
Weedicides															
W_1-Pendimethalin @ 1.0 kg/ha	5.8	10.4	37.3	41.7	4.4	5.3	5.6	4.0	5.9	6.7	9.8	26.0	1.4	1.7	70.1
W_2-Oxadiargyl @ 0.75 kg a.i./ha	7.9	15.4	40.0	43.0	4.8	5.6	5.9	4.0	6.3	7.1	10.2	29.9	1.7	2.2	68.0
S.Em±	0.29	0.15	0.27	1.06	0.20	0.20	0.19	0.14	0.16	0.42	0.13	0.60	0.07	0.09	8.68
CD (p=0.05)	0.85	0.44	0.79	NS	NS	NS	NS	NS	NS	NS	NS	1.75	0.22	0.26	24.96

*NPK: N- nitrogen, P-phosphorus and K-potash.

Table.2 Effect of sowing dates, NPK levels and weedicides on yield parameters and seed yield of nigella

Treatments	Siliqua per plant	Seed per siliqua	Siliqua size	Seed yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Test weight (g)
Sowing dates							
D_1-1st November	16.1	71.1	0.89	778.8	1484.0	2262.9	2.4
D_2-15th November	15.8	70.6	0.85	659.9	1249.2	1909.2	2.2
D_3-30th November	11.4	66.4	0.86	328.6	1012.0	1340.7	1.7
S.Em±	0.36	0.38	0.00	23.9	57.6	52.6	0.05
CD (p=0.05)	1.05	1.10	0.01	68.8	165.6	151.2	0.15
NPK levels							
F_1-30:30:15 kg/ha	12.8	66.4	0.85	490.7	1220.3	1711.1	2.1
F_2-40:40:20 kg/ha	15.7	72.6	0.88	677.2	1367.2	2044.4	2.2
F_3-50:50:25 kg/ha	14.9	69.2	0.86	599.6	1157.7	1757.4	2.0
S.Em±	0.36	0.38	0.00	23.9	57.6	52.6	0.05
CD (p=0.05)	1.05	1.10	0.01	68.8	165.6	151.2	0.15
Weedicides							
W_1-Pendimethalin @ 1.0 kg/ha	13.1	66.9	0.86	544.8	1110.7	1655.5	2.0
W_2-Oxadiargyl @ 0.75 kg a.i./ha	15.8	71.9	0.86	633.5	1386.1	2019.7	2.2
S.Em±	0.30	0.31	0.00	19.5	45.8	42.9	0.04
CD (p=0.05)	0.86	0.90	NS	56.1	131.7	123.5	0.12

*NPK: N- nitrogen, P-phosphorus and K-potash.

Table.3 Effect of sowing dates, NPK levels and weedicides on different weed parameters in nigella

Treatments	No. of weeds per m^2 area		Fresh weight(g) of weeds per m^2 area		Dry weight (g) of weeds per m^2 area	
	30 DAS	60 DAS	30 DAS	60 DAS	30DAS	60DAS
Sowing dates						
D_1-1st November	33.8	55.3	10.4	208.4	1.3	32.4
D_2-15th November	31.6	38.1	23.7	182.1	3.9	30.3
D_3-30th November	66.8	51.4	21.6	122.3	2.8	22.0
S.Em±	10.63	8.39	4.33	33.48	0.70	5.36
CD (p=0.05)	30.57	NS	NS	NS	2.03	NS
NPK levels						
F_1-30:30:15 kg/ha	63.4	63.8	24.5	216.9	3.6	32.7
F_2-40:40:20 kg/ha	30.1	37.5	14.3	120.5	2.1	26.0
F_3-50:50:25 kg/ha	38.7	44.6	17.0	175.4	2.3	26.0
S.Em±	10.63	8.39	4.33	33.48	0.70	5.36
CD (p=0.05)	NS	NS	NS	NS	NS	NS
Weedicides						
W_1-Pendimethalin @ 1.0 kg/ha	70.1	72.9	26.3	211.7	3.9	34
W_2-Oxadiargyl @ 0.75 kg a.i./ha	18.0	24.3	10.9	130.1	1.4	21.5
S.Em±	8.68	6.85	3.54	27.34	0.57	4.37
CD (p=0.05)	24.96	19.69	10.18	78.60	1.66	12.58

*NPK: N- nitrogen, P-phosphorus and K-potash.

Table.4 Interaction effect of different sowing dates, fertilizer levels and weedicides on growth parameters, yield attributes and seed yield of Nigella

Treatments	Plant height (cm)	No. of primary branches/plant	No. of secondary branches/plant	No. of weed /m^2	No. of siliqua/plant	Siliqua size (cm)	seeds/ siliqua	Seed yield (kg /ha)
$D_1F_1W_1$	39.1	5.9	6.4	116.3	13.0	0.89	63.3	647.7
$D_1F_1W_2$	39.0	6.5	8.2	35.3	17.8	0.84	71.9	811.1
$D_1F_2W_1$	46.1	6.4	9.4	60.6	11.9	0.88	77.4	674.4
$D_1F_2W_2$	46.4	7.2	10.3	40.0	22.6	0.92	77.7	840.0
$D_1F_3W_1$	42.7	7.0	8.9	53.6	18.0	0.91	65.4	922.2
$D_1F_3W_2$	46.0	7.0	8.2	32.0	17.4	0.90	75.4	777.7
D_2F1W_1	43.1	5.2	5.3	77.0	10.6	0.81	69.4	446.6
$D_2F_1W_2$	45.4	4.6	6.4	41.6	13.7	0.84	69.2	502.2
$D_2F_2W_1$	44.9	6.5	7.0	22.3	16.6	0.88	63.8	849.9
$D_2F_2W_2$	42.1	6.8	5.9	12.0	18.9	0.84	75.4	806.6
$D_2F_3W_1$	43.9	7.1	7.6	47.3	15.8	0.87	68.2	575.5
$D_2F_3W_2$	44.6	5.8	7.6	28.6	15.5	0.83	73.1	778.8
$D_3F_1W_1$	34.4	4.2	4.0	110.6	10.0	0.84	60.4	166.6
$D_3F_1W_2$	41.6	4.6	5.0	2.0	11.9	0.89	64.1	370.0
$D_3F_2W_1$	44.6	5.0	6.4	63.3	12.8	0.86	73.8	365.5
$D_3F_2W_2$	45.4	4.2	5.4	26.6	11.4	0.90	72.0	526.6
$D_3F_3W_1$	36.6	5.0	8.2	105.0	9.7	0.84	60.3	254.3
$D_3F_3W_2$	37.2	4.5	4.0	1.0	12.8	0.80	68.0	288.8
SEm±	3.19	0.59	1.26	20.55	0.90	0.01	0.94	58.6
CD (P=0.05)	NS	1.78	3.76	61.67	2.58	0.04	2.70	168.5

#D_1-1st sowing date (1st November), D_2-2nd sowing date (15th November), D3-3rd sowing date (30th November); F_1-(NPK:30:30:15 kg/ha), F_2-(NPK:40:40:20 kg/ha) and F3-(NPK:50:50:25 kg/ha) and W_1- pendimethalin @ 1.0 kg/ha and W_2-oxadiargyl @ 0.75 kg a.i./ha.

Table.5 Interaction effect of different sowing dates, NPK levels and weedicides on yield and economics of nigella at semi-arid region

Treatment combinations	Seed yield	Straw yield	Gross returns	Cost of cultivation	Net returns	B:C ratio
$D_1F_1W_1$	647.7	1463.3	119512.6	42632.9	76879.7	2.80
$D_1F_1W_2$	811.1	1366.6	148731.2	43445.4	105285.8	3.42
$D_1F_2W_1$	674.4	1547.7	124487.4	43793.6	80693.8	2.84
$D_1F_2W_2$	840.0	2137.8	155475.6	44606.1	110869.5	3.48
$D_1F_3W_1$	922.2	722.2	167440.4	44539.7	122900.7	3.76
$D_1F_3W_2$	777.7	1666.6	143319.3	45352.2	97967.1	3.16
$D_2F_1W_1$	446.6	886.6	82161.2	42632.9	39528.3	1.93
$D_2F_1W_2$	502.2	1408.9	93213.8	43445.4	49768.4	2.15
$D_2F_2W_1$	849.9	1016.7	155015.4	43793.6	111221.8	3.54
$D_2F_2W_2$	806.6	1393.2	147974.4	44606.1	103368.3	3.32
$D_2F_3W_1$	575.5	1413.3	106416.6	44539.7	61876.9	2.39
$D_2F_3W_2$	778.8	1376.6	141560.6	45352.2	96208.4	3.12
$D_3F_1W_1$	166.6	1077.7	32143.4	42632.9	-10489.5	0.75
$D_3F_1W_2$	370.0	1118.9	68837.8	43445.4	25392.4	1.58
D_3F_2W1	365.5	1078.9	67947.8	43793.6	24154.2	1.55
$D_3F_2W_2$	526.6	1028.8	96845.6	44606.1	52239.5	2.17
$D_3F_3W_1$	254.3	790.0	47354	44539.7	2814.3	1.06
$D_3F_3W_2$	288.8	977.8	53939.6	45352.2	8587.4	1.19

#D_1-1st sowing date (1st November), D_2-2nd sowing date (15th November), D3-3rd sowing date (30th November); F_1-(NPK:30:30:15 kg/ha), F_2-(NPK:40:40:20 kg/ha) and F3-(NPK:50:50:25 kg/ha) and W_1- pendimethalin @ 1.0 kg/ha and W_2-oxadiargyl @ 0.75kg a.i./ha.

The interaction effect of different treatments *viz*., sowing dates, fertilizer doses and weedicides application on yield attributing characters and seed yield of nigella crop (Table 4), demonstrated that the treatment combination of $D_1xF_2xW_2$ given highest average number of siliqua/plant (22.6), siliqua size (0.92 cm) and number of seed/siliqua (77.7). Likewise the highest seed yield of nigella 922.2 kg/ha was obtained in the treatments combination of D1xF3xW1 which was statistically at par with treatments combination of $D_1xF_2xW_2$ (840 kg/ha).

Economic analysis

The economic analysis of different treatments as well as treatments combinations keeping three different sowing dates, fertilizers levels (NPK kg/ha) and pre-emergence applications of two weedicides were applied and the data on these parameters are arranged in Table 5. It was found that the sowing dates, fertilizer doses and weedicide application were widely influenced the gross return, net return as well as benefit cost ratio (BCR). The maximum gross return (Rs. 167440.4 ha^{-1}), net return (Rs. 122900.7 ha^{-1}) and BCR (3.76) were obtained in treatments combination of $D_1xF_3xW_1$ i.e. 1st November sowing date with fertilizers doses (NPK 50:50:25 kg/ha) and pre-emergence application of Pendimethalin @ 1 kg/ha) which was statistically on par with the treatments combination of $D_1xF_2xW_2$ (1st November sowing date, 40:40:20 kg/ha NPK doses and pre-emergence application of oxadiargyl @ 75 g a.i./ha is due to higher plant growth and yield attributes in the treatments.

Based on the results of field experiment, it may be concluded that under the 3rd agro climatic zone of Rajasthan the most suitable date of sowing for nigella crop was 1st November for getting maximum seed yield (778.8 kg/ha), net returns of Rs. 122900.7 ha^{-1} and B:C ratio (3.75). It was also observed that the appropriate dose of fertilizer (NPK level) was 40:40:20 kg/ha, whereas the application of weedicide oxadiargyl 75 g a.i./ha has also given minimum weed count in nigella field during *Rabi* season 2016-17.

References

Al-Ali, A., Alkhawajah, A.A., Randhawa, M.A. and Shaikh, N.A. (2008). Oral and intraperitoneal LD50 of thymoquinone, an active principle of Nigella sativa, in mice and rats. *J Ayub Med Coll Abbottabad*, 20 (2):25-27.

Bhat, V.R. and Sulikeri, G.S. (1992). Effect of nitrogen, phosphorous and potessium on seed yield and yield attributes of coriander (*Coriandrum sativum* L.). *Karnataka J. Agric. Sci*., 5 (1): 26-30.

Bita, A., Rosu, A.F., Calina, D., Rosu, L., Zlatian, O. and Dindere, C. (2012). An alternative treatment for Candida infections with *Nigella sativa* extracts. *Eur J Hosp Pharm.*, 19:162.

Channabasavanna, A.S., Nagappa and Biradar, D.P. (2008). Productivity and economic analysis of ajowan as influenced by spacing and fertilizer levels. *Karnataka Journal of Agricultural Science*, 21(1): 106-107.

Channabasavanna, A.S., Yalamali, S.G. and Biradar, D.P. (2002). Nutrient requirement of coriander in Tungabhadra project area of Karnataka. *Journal of Maharashtra Agricultural Universities*, 27(1): 38-39.

El-Abhar, H.S., Abdallah, D.M. and Saleh, S. (2003). Gastroprotective activity of Nigella sativa oil and its constituent, thymoquinone, against gastric mucosal injury induced by ischaemia/reperfusion in rats, *J. Ethnopharmacol*., 84 (2-3):251-258.

Goswami, S.B. (2011). Effect of irrigation and nitrogen on growth, yield and

water-use efficiency of black cumin (*Nigella sativa*) in lower Indo-Gangetic plains. *The Indian Journal of Agricultural Sciences*, 81(6): 40-43.

Haq, M.Z., Hossain, M.M., Haque, M.M., Das, M.R. and Huda, M.S. (2015). Blossoming characteristics in black cumin genotypes in relation seed yield influenced by sowing time, *American Journal of Plant Sciences*, 6: 1167-1183.

Hussain, A., Nadeem, A., Ashraf, I. and Awan, M. (2009). Effect of weed competition periods on the growth and yield of black seed (*Nigella sativa* L.). *Pak J. Weed Sci. Res*, 15:71-81.

Keshri, G., Singh, M.M., Lakshmi, V. and Kamboj, V.P. (1995). Post-coital contraceptive efficacy of the seeds of Nigella sativa in rats. *Indian J Physiol Pharm*., 39 (1):59-62.

Mbarek, A., Elabbadi, N., Bensalah, M., Gamouh, A. and Aboufatima, B. (2007). Anti-tumor properties of black seed (*Nigella sativa* L.) extract, *Brazilian Journal of Medical and Biological Research*, 40:839-847.

Meena, N.K., Lal, G., Meena, R.S., Harisha, C.B. and Meena, S.R. (2017). Pest scenario of coriander (*Coriandrum sativum* L.) and population dynamics in semi-arid region of Rajasthan. *International Journal of Tropical Agriculture*, 35 (4): 779-783.

Meena, S.S. and Mehta, R.S. (2007). Effect of weed management practices on growth and yield of coriander (*Coriandrum sativum* L.). *International Journal of Tropical Agriculture*, 26(1):169-171.

Meena, S.S., Kakani, R.K. and Mehta, R.S. (2009). Economic feasibility of weed management practices in cumin (*Cuminum cyminum* L.). *Journal of Spices and Aromatic Crops*, 18(1): 9–12.

Meena, S.S., Mehta, R.S. Meena, R.D., Meena, R.L. and Sharma, D.K. (2014). Economic feasibility of weed management practices in nigella (*Nigella sativa* L.). *Journal of Spices and Aromatic Crops*, 23(2): 224–228.

Melkie, Y., Yeshanew, A. and Wosen,T. (2008). Response of black cumin (*Nigella sativa* L.) to N and P fertilizers in Takusa District, North Gondar administrative zone Gondar Agricultural Research Centre. Proceedings: 3rd Annual Regional Conference on *Completed Crop Research Activities*, Volume; 31, Addis Ababa University, pp: 1-25.

Mollafilabi, A., Moodi, H., Rashed, M.H. and Kafi, M. (2009). Effect of plant density and nitrogen on yield and yield components of black cumin (*Nigella sativa* L.). In Proceedings: *International Symposium on Medicinal and Aromatic Plants-SIPAM* held at Djerba, Tunisia. Institute des Regions Arides, Tunisia, pp: 115-126.

Morsi, N.M. (2000). Antimicrobial effect of crude extracts of Nigella sativa on multiple antibiotics-resistant bacteria. *Acta Microbiol Pol*., 49(1):63-74.

Naghera, R.P., Sukhadia, N.M. and Ramani, B.B. (2000). Effect of sowing dates and varying levels of nitrogen and phosphorus on coriander (*Coriandrum sativum* L.). *Gujarat Agricultural University Research Journal*, 26(1): 52-54.

Nataraja, A., Farooqi, A.A., Sreeramu, B.S. and Srinivasappa, K.N. (2003). Influence of nitrogen, phosphours and potassium on growth and yield of black cumin *(Nigella sativa* L.). *Journal of Spices and Aromatic Crops*, 12(1): 51-54.

Patel, S.M., Amin, A.U. and Patel, J.A. (2016). Effect of weed management practices on weed indices, yield and

economics of cumin (*Cuminum cyminum* L.). *International J. Seed Spices*, 6(2)*:78-83.*

Riaz, M., Sayed, M. and Chaudhary, F.M. (1996). Chemistry of the medicinal plants of the genus *Nigella*. *Hamdard Medicus*, 39: 40-45.

Shadia, K.A., Mallea, E.I. and Aly, A.F. (1998). Effect of sowing dates on *Nigella sativa*. *Egyptian Journal of Agricultural Research*, 76(3): 1145-1156.

Sharangi, A.B. and Roychowdhury, A. (2014). Phenology and yield of coriander (*Coriandrum sativum* L.) at different sowing dates. *Journal of Plant Science*, 9(2): 33-42.

Sultana, S., Asif, H.M., Akhtar, N., Iqbal, A., Nazar, H. and Rahman, R.U. (2015). *Nigella sativa*: Monograph. *Journal of Pharmacognosy and Phytochemistry*, 4(4): 103-106.

Umar, S., Zargan, J., Umar, K., Ahmad, S., Katiyar, C.K. and Khan, H.A. (2012). Modulation of the oxidative stress and inflammatory cytokine response by thymoquinone in the collagen induced arthritis in Wistar rats. *Chem Biol Interact*., 197 (1): 40-46.

Yadav, A., Patel, J.C., Mehta, R.S. and Meena, T. (2010). Suitable method for weed management in cumin (*Cuminum cyminum* L.). *Indian J. Weed Sci.*, 42(1&2): 111-113.

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: 83–85.

Zaoui, A., Cherrah, Y., Mahassini, N., Alaoui, K., Amarouch, H. and Hassar, M. (2002). Acute and chronic toxicity of *Nigella sativa* fixed oil. *Phytomedicine*, 9(1): 69-74.

How to cite this article:

Ved Kant, S.S. Meena, N.K. Meena and Lal, G. 2018. Influence of Different Dates of Sowing, Fertilizer Level and Weedicides on Growth and Yield of Nigella (*Nigella sativa* L.) under Semi-Arid Conditions. *Int.J.Curr.Microbiol.App.Sci.* 7(09): 1156-1167.
doi: https://doi.org/10.20546/ijcmas.2018.709.137