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Effect of NPK on qualitative traits of Kalaunji

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Abstract
The judicial use of NPK performs more affluent plant growth, which led to maximum number of pods, resulting in higher yields. Keeping view, the present study is to be conducted on the effect of N, P and K on growth, yield and optimum dose of N, P & K for maximizing yield of Kalonji. In this experiment different combinations of NPK were tried to assess for growth and yield characters under the field condition. The research experiment was conducted in a RBD with three replications and nine treatments. All the parameters were recorded at 45, 90 DAS and at harvest. It is concluded that the different levels of NPK significantly influenced the growth and yield attributes of Kalonji. Hence, out of nine treatments NPK 70:70:55 kg ha-[1] was best for enhanced growth and yield of Kalonji.

Keywords: Nigella, benefit cost ratio, growth and yield, NP&K

Introduction
Black cumin (Kalaunji) is an annual herbaceous plant belonging to the Ranunculaceae family. One of the most important constituents of volatile oil of the Kalaunji seeds are thymoquinone (2-isopropyl-5-methyl-1, 4-benzoquinone), which is widely used in traditional medicine. The main alkaloids found in Kalaunji seeds contains a bitter principal (Nigellin), tannins, resins, proteins, reducing sugars (Mostly glucose), saponins and Arabic acids. The seeds of black cumin have exerted important health-beneficial effects including carminative, stimulant, diuretic antioxidant, anti-inflammatory, and anti-cancer effects. (Dhakad *et al*., 2021) [3].
Major and micro nutrients are one of the most important factors in enhancing crop profitability. The presence of nitrogen in the protein structure is well-known; Nitrogen plays a model role in the synthesis of plant components by various enzymes (Khalid and Shedeed, 2015) [5]. Judicious use of nitrogen promotes vegetative growth which ultimately increases the crop productivity. The mature seeds of plant rich in phosphorus concentration and are required in large quantities in shoots and root tips, where metabolism is high and cell division is rapid. The role of Phosphorus in root, fruit and seed development and flower initiation is described by Khalid and Shedeed, 2015 [5]. Phosphorus play a prominent role in increasing plant height, no. of branches, fresh and dry weight and oil yielding capacity in plants (Sushama and Jose, 1994) [10]. Potassium involved in movement of H_2O, nutrients and enzyme activation in plant tissue, which affects protein, starch and adenosine triphosphate (ATP) production. The production of ATP can regulate the rate of photosynthesis.

Materials and Methods
The investigation entitled “Effect of NPK on qualitative traits of Kalonji” was conducted at the “Horticulture Research Farm”, Department of PSMA, R.V.S.K.V.V. Campus-College of Horticulture, Mandsaur, (M.P.) during *Rabi* season of 2020-2021. The variety used in this experiment is AN-1 was obtained from NRCSS, Tabiji Farm, Ajmer, Rajasthan. The seeds were sown at a depth of 2.5 cm in row spaced at 30 cm using 8 kg seeds/ha and 2-3 seeds were sown at a spacing of 30 x 15 cm. The Observation recorded during course of investigation are morphological parameters at 45, 90 DAS and at harvest i.e. plant height (cm), number of branches per plant, fresh weight of plants (g), dry weight of plants (g), days to 50% germination, days to 50% flowering, days to maturity. The yield parameters recorded during course of investigation are number of capsules per plant, number of seeds per capsules, seed yield

(g/plant), seed yield (q/ha), biological yield (q/ha), harvest index (%), test weight (g), oil content in seed (%).The economics of treatments is the most important consideration for making any recommendation to the farmer for its adaptation. For calculating economics, the average yield (outputs) along with prevailing market rate for inputs were used. B: C ratio was computed by dividing gross return with cost of cultivation for each treatment.

The data obtained on various observations for each treatment were subject to "Analysis of variances" as recommended by Panse and Sukhatme (1985) [8]. The critical difference (C.D.) was calculated to assess the significance of difference between treatments, whenever the results were found significant through 'F' test, CD at 5% level of significance was determined. S.Em. (±) and CD are calculated using the following formula.

$$S.E.(d) = \sqrt{\frac{2MSE}{r}}$$

CD = S.E. (d) × t Value at 5% at error degree of freedom.

Results and Discussion

Morphological Traits

The Result revealed that treatment T_8 – 70:70:55 kg/ha NPK recorded the maximum plant height (11.53, 76.87 and 81.23 cm), number of branches plant-1 (7.07, 13.20 and 17.53), maximum fresh weight (11.08, 72.82 and 79.77 g plant-1) and dry weight of plant-1 (3.16, 19.92 and 23.75 g), early germination (10.00), flowering (80.00) and maturity (140). The reason may be due to the sufficient amount of nitrogen promotes vegetative growth, which in itself increases plant growth, stimulating processes such as cell division, cell enlargement and metabolic processes by Ali *et al.* (2015) [1]. Similar results were obtained by Hammo (2008) [4], Mohamed *et al.* (2000) [6] and Özgüven and Sekeroglu (2007) [7] and Yimam *et al.* (2015) [11].

Table 1: Effect of different levels of NPK on morphological parameters

Treatments	Plant height (cm) plant^{-1} at harvest	Number of branches plant^{-1} at harvest	Fresh weight of (g plant^{-1}) at harvest	Dry weight (g plant^{-1}) at harvest	Days to 50% germination	Days to 50% flowering	Days to maturity
T_1 - NPK – 40:20:20 Kg/ha	64.34	15.20	60.34	15.93	13.67	87.00	144.00
T_2 - NPK – 40:30:25 Kg/ha	67.96	15.53	62.96	16.74	13.33	86.67	144.00
T_3 - NPK – 50:40:30 Kg/ha	69.55	15.80	64.55	17.41	12.00	85.67	144.00
T_4 - NPK – 50:50:35 Kg/ha	73.01	16.20	68.01	17.82	12.00	84.33	144.00
T_5 - NPK – 60:55:40 Kg/ha	73.73	16.33	70.73	19.81	11.67	83.33	142.00
T_6 - NPK – 60:60:45 Kg/ha	76.39	16.53	73.39	20.98	11.00	82.33	142.00
T_7 - NPK – 70:65:50 Kg/ha	78.09	17.33	76.09	22.62	10.00	80.00	140.00
T_8 - NPK – 70:70:55 Kg/ha	81.23	17.53	79.77	23.75	10.00	80.00	140.00
T_9 - NPK – 80:75:60 Kg/ha	76.42	16.80	75.97	22.01	10.33	80.33	142.00
S.Em (±)	1.29	0.06	3.00	0.24	0.14	0.12	0.66
CD (5%)	3.88	0.17	8.98	0.71	0.41	0.37	1.97

Yield Parameters

During the field, experiment observed that the treatment T_8 – 70:70:55 kg/ha NPK reflected the maximum value for no. of capsules plant-1 (77.13), no. of seeds capsules-1 (106.87), seed yield gram plant-1 (19.69), seed yield q ha-1 (10.24), biological yield q/ha (43.09), test weight (3.17 g), harvest index (27.91%) and oil content in seed (0.46%). When yielding parameters interacting with NPK may be directly correlated with the synthesis of more chlorophyll and also associated with more photosynthesis which ultimately produces higher yield with respect to seeds and oils. This finding was given by Ashraf *et al.* (2006) [2] and similar result was given by Yimam *et al.* (2015) [11]. Increased yields may also be associated with the role of fertilizers in improving the absorption of nutrients by the roots system, increased chlorophyll content, photosynthesis activity and protein content in cultivated plants given by Rana *et al.* (2012) [9]. Oil content depends on crop varieties and regional environmental conditions as well as on growing techniques, NPK application, frequency and extent of irrigation by Ashraf *et al.* (2006) [2].

Table 2: Effect of different levels of NPK on yield parameters

Treatments	Number of capsules plant^{-1}	Number of seeds capsules^{-1}	Seed yield (g plant^{-1})	Seed yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest index (%)	Test weight (g)	Oil content in seed (%)
T_1 - NPK – 40:20:20 Kg/ha	49.73	82.93	4.13	6.68	28.16	23.74	2.08	0.39
T_2 - NPK – 40:30:25 Kg/ha	51.90	86.40	5.62	7.17	29.53	24.57	2.15	0.40
T_3 - NPK – 50:40:30 Kg/ha	57.80	88.33	7.29	7.83	31.52	25.21	2.21	0.41
T_4 - NPK – 50:50:35 Kg/ha	61.80	91.80	9.10	8.45	32.87	25.81	2.31	0.42
T_5 - NPK – 60:55:40 Kg/ha	63.87	96.87	11.12	9.03	34.22	26.31	2.44	0.42
T_6 - NPK – 60:60:45 Kg/ha	67.80	98.80	13.35	9.34	35.72	26.85	2.60	0.43
T_7 - NPK – 70:65:50 Kg/ha	75.40	103.20	17.68	9.80	38.87	27.34	2.85	0.44
T_8 - NPK – 70:70:55 Kg/ha	77.13	106.87	19.69	10.24	43.09	27.91	3.24	0.46
T_9 - NPK – 80:75:60 Kg/ha	72.27	101.20	15.89	9.54	37.17	27.06	2.72	0.43
S.Em (±)	1.15	1.10	0.21	0.07	0.42	1.18	0.04	0.01
CD (5%)	3.44	3.30	0.64	0.20	1.26	3.53	0.11	0.03

Economics of the Treatments: The gross return, net return and the benefit-cost ratio were increased by the application of different levels of NPK. The maximal net returns (Rs.154920.00) and B:C ratio (5.27:1) were recorded in T_8 - 70:70:55 kg/ha NPK while, the lowest in T_1 – 40:20:20 kg/ha NPK. (Rs. 91740.00) net returns and (3.22:1) B: C ratio. Similar findings were reported by Rana *et al.* (2012) [9].

Table 3: Effect of different levels of NPK on economics of Nigella

Treatments	Total cost	Yield (q ha^{-1})	Gross return	Net profit	B:C ratio
T_1 - NPK – 40:20:20 Kg/ha	28500.00	6.68	120240.00	91740.00	3.22:1
T_2 - NPK – 40:30:25 Kg/ha	28650.00	7.17	129060.00	100410.00	3.51:1
T_3 - NPK – 50:40:30 Kg/ha	28750.00	7.83	140940.00	112190.00	3.90:1
T_4 - NPK – 50:50:35 Kg/ha	28790.00	8.45	152100.00	123310.00	4.28:1
T_5 - NPK – 60:55:40 Kg/ha	28850.00	9.03	162540.00	133690.00	4.63:1
T_6 - NPK – 60:60:45 Kg/ha	28900.00	9.34	168120.00	139220.00	4.82:1
T_7 - NPK – 70:65:50 Kg/ha	29200.00	9.80	176400.00	147200.00	5.04:1
T_8 - NPK – 70:70:55 Kg/ha	29400.00	10.24	184320.00	154920.00	5.27:1
T_9 - NPK – 80:75:60 Kg/ha	28945	9.54	171720	142775.00	4.93:1

Conclusion

After one year of research, it is concluded that the different levels of NP&K influenced the growth and yield attributes of Kalonji. Hence, out of 09 treatments T_8 -70:70:55 kg, ha-1 NPK performed best with respect to all traits reported during investigation.

Future Scope

1. The same experiment may be repeated by extension fancies of KVK in farmer's fields under OFT's and FLD's for the confirmation of the result of the present work.
2. Same experiment can be repeated with more varieties and at different locations.

Conflict of Interest

I Isha Verma certify that I have participated sufficiently in the conception and design of this work and the analysis of the data as well as the writing of the manuscript, to take public responsibility for it. I believe the manuscript represents valid work. I have reviewed the final version of the manuscript and approve it for publication. Neither has the manuscript nor one with substantially similar content under my authorship been published nor is being considered for publication elsewhere. I give my consent to publish the paper in your reputed journal.

Author's Contribution

Contribution of each author has to be mentioned in the following heads. Conceptualization and designing of the research work (Isha Verma, K.C. Meena & I.S. Naruka); Execution of field/lab experiments and data collection (Nitin Soni); Analysis of data and interpretation (Om Singh); Preparation of manuscript (Om Singh& B.K. Kachouli).

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References

1. Ali MMK, Hasan MA, Islam MR. Influence of fertilizer levels on the growth and yield of black cumin (*Nigella sativa* L.). The Agriculturist. 2015;13(2):97-104.
2. Ashraf M, Ali Q, Iqbal Z. Effect of nitrogen application rate on the content and composition of oil, essential oil and minerals in black cumin (*Nigella sativa* L.) seeds. J Sci Food Agric. 2006;86(6):871-876.
3. Dhakad DK, Meena KC, Naruka IS, Soni N. Effect of foliar application of micronutrients on growth and yield of black cumin (*Nigella sativa* L.). Int J Seed Spices. 2021;11(2):58-62.
4. Hammo YH. Effect of high levels of nitrogen and phosphorus fertilizer, pinching, and seed rate on growth and yield components of *Nigella sativa* L. 1-vegetative growth and seed yield. Mesopotamia J Agric. 2008;36(1):1815-316X.
5. Khalid KA, Shedeed MR. Effect of NPK and foliar nutrition on growth, yield and chemical constituents in *Nigella sativa* L. J Mater Environ Sci. 2015;6(6):1709-1714.
6. Mohamed SA, Medani RA, Khafaga ER. Effect of nitrogen and phosphorus applications with or without micronutrients on black cumin (*Nigella sativa* L.) plants. Ann Agric Sci Cairo. 2000;3:1323-1338.
7. Ozguven M, Sekeroglu N. Agricultural practices for high yield and quality of black cumin (*Nigella sativa* L.) cultivated in Turkey. Acta Hortic. 2007;756:329-337.
8. Panse VG, Sukhatme PV. Statistical methods for agriculture workers. New Delhi: Indian Council of Agriculture Research; c1985. p. 155.
9. Rana S, Singh PP, Naruka IS, Rathore SS. Effect of nitrogen and phosphorus on growth, yield and quality of black cumin (*Nigella sativa* L.). Int J Seed Spices. 2012;2(2):5-8.
10. Sushama PK, Jose AL. Nutrition of ginger. In: Advances in Horticulture, Plantation and Spices Crops Part 1 (eds. Chadha KL, Rethinam P). Malhotra Publishing House, New Delhi. 1994;9:490-497.
11. Yimam E, Nebiyu A, Mohammed A, Getachew M. Effect of nitrogen and phosphorus fertilizers on growth, yield and yield components of black cumin (*Nigella sativa* L.) at Konta district, South West Ethiopia. J Agronomy. 2015;14(3):112-120.