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Performance of elite Ajwain (*Trachyspermum ammi* L.) genotypes in northern transitional tract of Karnataka

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Abstract
A field experiment was conducted to study the performance of elite Ajwain (*Trachyspermum ammi* L.) genotypes in northern transitional tract of Karnataka at Department of Horticulture, University of Agricultural Sciences, Dharwad during 2018-19. The experiment was laid out in Randomized Block Design comprised of seven genotypes (V_1 - AA-1, V_2 - AA-2, V_3 - AA-93, V_4 - Lam Sel-1, V_5 - LTa-26, V_6 - DAC-1 and V_7 - DAC-2) replicated thrice. Among seven genotypes AA-93 recorded minimum number of days for 50% flowering (69.33 days). LTa-26 produced the maximum number of umbels per plant (262.8) and test weight (1.63 g) and the highest seed yield was also recorded in LTa-26 (7.47 q ha^{-1}). Whereas, Lam Sel-1 recorded the highest essential oil content (4.92%) and found superior among all the genotypes with respect to essential oil content. Among seven genotypes evaluated, LTa-26 and Lam Sel-1 are superior genotypes in terms of yield and essential oil content respectively.

Keywords: Ajwain, essential oil, genotypes, yield

Introduction
Ajwain (*Trachyspermum ammi* (L.) Sprague) belongs to the family Apiaceae. It is native to Egypt and is grown in India, Iran and Afghanistan. It is also known as Bishop's weed and Carum in English. Plant is an annual herbaceous in nature, bearing light brown fruits which constitute the spice. Flowers are protrandous in nature and therefore 70-77% cross pollination is reported with honey bees as they are main pollinators (Tiwari and Agarwal, 2004) [9]. Plant parts usually used are seed, herb and volatile oil. The seed of Ajwain possesses an antispasmodic, stimulant and carminative properties. The seeds of which are used for flavouring foods and preservatives. The essential oil from seeds used in perfumery, essence and medicinal preparations. Traditionally, Ajwain used as an important remedial agent for indigestion, diarrhoea, cholera, stomach pain, abdominal tumours, gastric, urinary trouble, bronchial problems, piles, lack of appetite and asthama. Seed contains volatile oil (2-5%) which contains thymol (35-60%) the main constituent. The aroma of Ajwain oil is spicy, slightly fatty, persistant and with a burning sensation. The oil of Ajwain is almost colourless to pale yellowish liquid possessing a characteristic odour of thymol and sharp burning taste. The oil is used in several *Ayurvedic* medicines and industries.

Ajwain has remained a neglected crop though it has a vast spice and medicinal value. It has taken a back seat behind the major seed spices like cumin, coriander and fennel. Consequently, the research carried out on crop improvement, agro techniques and plant protection are limited. The productivity of the crop has remained dismally low.

With the increase in demand for Ajwain, farmers are taking up the crop in non-traditional areas. North Karnataka especially drier districts is one such region. Whenever a crop is taken up in a new area, following the practices adopted elsewhere is not appropriate. Hence, standardization of various cultural practices for the crop including suitable varieties is of prime importance. The performance of Ajwain genotypes differ from one region to another region. There is no suitable variety recommended for this region hence, this study was undertaken to find out suitable variety for the northern transitional tract of Karnataka.

Material and Methods

The present investigation on Ajwain was undertaken during *kharif* 2018-19 at Spice Unit, MARS, UAS, Dharwad to study the performance of elite Ajwain (*Trachyspermum ammi* L.) genotypes in northern transitional tract of Karnataka. The experiment was laid out in a Randomized Block Design with three replications. The experiment consisted of seven genotypes (V_1 -AA-1, V_2 -AA-2, V_3 - AA-93, V_4 -Lam Sel-1, V_5 –LTa-26, V_6 –DAC-1 and V_7 -DAC-2). The land was ploughed, harrowed and was brought to a fine tilth. Experimental area was divided into plots according to plan, well decomposed farmyard manure was applied as a basal dose at the rate of 20 tonnes per hectare and also recommended dose of fertilizer (100: 50: 50 NPK kg ha^{-1}) was applied in the form of urea, DAP and MOP. The seeds were sown as per the treatments. When seedlings were fully emerged out in the field the excess seedlings in rows were thinned out to maintain a spacing of 30 cm between two plants with in the rows. Five plants from each treatment and replication were randomly selected and tagged for recording observations with respect to growth and yield attributes. The essential oil of Ajwain was extracted from dried Ajwain seeds by hydro-distillation using Clevenger apparatus (Sadgrove and Jones, 2015) [7]. The experimental data were subjected to statistical analysis of variance according to Panse and Sukhatme (1995) [6]. Statistical significance was tested by F value at five % level of significance. Critical differences at five % were worked out, where "F" test was found significant.

Results and Discussion

Growth parameters

The data pertaining to plant height, days taken for 50% flowering and number of branches per plant given in Table 1.

At the time of harvest, the genotype AA-1 recorded the highest plant height (114.33 cm) and it is on par with DAC-1 (113.70 cm) and Lam Sel-1 (108 cm), followed by LTa-26 (104.11 cm) whereas, the lowest plant height at the time of harvest was recorded in AA-93 (88.13 cm). Among the genotypes, the highest number of branches (16.00) was recorded in AA-1, which is on par with Lam Sel-1 (15.40) and LTa-26 (14.87) followed by AA-2 (13.47) whereas, the lowest number of branches was recorded in DAC-1 (12.00).

This variation in plant height and number of branches might be due to varietal character. Datta *et al.* (2001) [2] in Ajwain observed that the variation in plant height and number of primary branches per plant may be due to hereditary traits which resulted in varied growth rate.

Minimum days for 50% flowering was recorded in AA-93 (69.33 days), Which was on par with DAC-2 (75.33 days) followed by DAC-1 (77.33 days) whereas, the maximum number of days taken to 50% flowering was recorded in AA-2 (90.33 days) which is on par with Lam Sel-1 (85.67 days) followed by LTa-26 (80.67 days) and AA-1 (80 days)

Genotypes showed major differences in respect of days to flowering. Those which required maximum period for flowering resulted in higher yield in general. Many research findings shows that higher the number of days for 50% flowering higher will be the yield (Anitha *et al.*, 2016 in fenugreek) [1].

Yield parameters

The data pertaining to number of umbels per plant, test weight of seeds and seed yield per hectare (q) was significantly influenced by different genotypes as depicted in Table 2.

Among the genotypes, LTa-26 recorded the maximum number of umbels (262.8) which is on par with AA-1 (235), followed by Lam Sel-1 (201.7) whereas, the minimum number of umbels was recorded in DAC-2 (148.7).

The genotypes LTa-26 recorded the highest test weight (1.63 g) which was found on par with AA-1 (1.61 g), Lam Sel-1 (1.56 g) and DAC-1 (1.54 g) whereas, the lowest test weight was recorded in AA-93 (1.34 g).

The higher yield in LTa -26 was contributed by higher number of umbels per plant and 1000 seed weight. Thousand seed weight is one the important yield deciding parameters. The variation in number of umbels and test weight among the genotypes may be due to hereditary traits of a variety. Similar finding was also reported by Meena (2012) [5] in Ajwain that variation in yield attributes may be due to genetic character of a variety.

Among the genotypes, the highest seed yield (7.47 q ha^{-1}) was obtained from the genotype LTa -26, which is on par with genotype AA-1 (6.96 q ha^{-1}) followed by Lam Sel-1 (5.99 q ha^{-1}). Whereas, the minimum seed yield (4.93 q ha^{-1}) was observed in both the genotypes DAC-2 and AA-93. This variation could be due to its adaptability of genotypes to a shorter growing season available in South Indian condition and genetic character of particular genotypes. Considerable difference in the seed yield among the genotypes of the Ajwain was also reported earlier by Meena, 2012 [5].

The present study has shown the superiority of the genotype LTA-26 among the seven genotypes evaluated for the seed yield. This genotype also had performed well in a similar condition in Guntur, Andhra Pradesh has revealed by Giridhar *et al.* (2016) [4]. Performance of variety differs from one region to another region. The variety AA-27 and AA-2 recorded maximum yield under Udaipur condition reported by Meena (2012) [5] whereas, the same variety (AA-2) did not perform well under this region.

Quality parameter: The data on essential oil content was significantly influenced by different genotypes are presented in Table 2. Lam Sel-1 recorded the highest essential oil content (4.92%) which was found on par with AA-1 (4.63%), AA-2 (4.54%) and LTa-26 (4.51%) followed by DAC-1 (4.42%) whereas, the lowest essential oil content was recorded in DAC-2 (3.52%) and on par with AA-93 (3.68%).

In Ajwain, quality is judged in terms of essential oil content. Among different genotypes, Lam Sel-1 yielded the maximum oil content. The quality and yield of essential oil depends on environmental factors, genotypes and methods of harvesting (Shivaprasad *et al.*, 2018) [8] in fennel. It was noted that the essential oil content was higher in long duration genotypes which required longer period for flowering and maturity (Farooq, 2013) [3] in coriander.

Table 1: Performance of elite Ajwain genotypes with respect to growth attributes

Genotypes	Plant height at harvest (cm)	Days taken for 50% flowering	No. of branches per plant
AA-1	114.33	80.00	16.00
AA-2	92.73	90.33	13.47
Lam Sel-1	108.00	85.67	15.40
AA-93	88.13	69.33	12.87
LTa-26	104.11	80.67	14.87
DAC-1	113.70	77.33	12.00
DAC-2	88.57	75.33	12.13
Mean	101.37	79.81	13.82
S.Em.±	3.03	2.34	0.73
C.D. at 5%	9.35	7.22	2.26

Table 2: Performance of elite Ajwain genotypes with respect to yield and quality attributes

Genotypes	No. of umbels per plant	Test weight (g)	Seed yield per hectare (q)	Essential oil (%)
AA-1	235.0	1.61	6.96	4.63
AA-2	161.1	1.46	5.05	4.54
Lam Sel-1	201.7	1.56	5.99	4.92
AA-93	162.0	1.34	4.93	3.68
LTa-26	262.8	1.63	7.47	4.51
DAC-1	174.7	1.54	5.92	4.42
DAC-2	148.7	1.43	4.93	3.52
Mean	192.2	1.51	5.89	4.32
S.Em.±	10.38	0.04	0.21	0.13
C.D. at 5%	31.97	0.13	0.63	0.41

Conclusion

Thus, from the above observations it could be concluded that Lta-26 and Lam Sel-1 are superior among all the genotypes in terms of yield and essential oil content respectively and found suitable for this region.

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