

## Provenance Studies on Growth, Seed Yield and Quality of Chilli Genotypes (*Capsicum annum* L.)

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**ABSTRACT** Byadagi kaddi chilli variety exhibited significantly maximum seed yield and its components over Dyavanur local variety irrespective of localities. Byadagi kaddi variety recorded maximum plant height (92.21cm), number of primary (5.62) and secondary branches per plant (10.83), with early flowering (43.10 days) and maturity over Dyavanur local (82.91 cm, 4.70, 9.82, 46.40 days respectively) and also recorded significantly maximum fruit yield (1348 kg/ha), seed yield (495.42 kg/ha), fruit length (15.86 cm) and number of fruits per plant (109.50) over Dyavanur local (1227 kg, 405.90 kg, 12.60 cm, 91.08 respectively), where as Dyavanur local variety had maximum fruit girth (1.16cm), fruit weight (1.29g), number of seeds per fruit (81.50) and 100 seed weight (5.49g) compared to Byadagi kaddi variety (0.84 cm, 1.09 g, 66.62 and 4.85 g respectively). Dharwad location produced significantly maximum fruit yield, seed yield and seed quality parameters of chilli over Annigeri and Hanumanamatti locations. Byadagi kaddi variety grown at Dharwad location performed better with respect to growth and yield parameters compared to Dyavanur local variety.

Key words: Provenance, growth, seed yield, quality, chilli

The place of production is one of the most important factors which influences growth, seed yield and quality parameters. Weather conditions like temperature, relative humidity, photoperiod and wind velocity vary from location to location resulting in differential seed yield and quality. Chilli is highly sensitive to environmental hazards like high temperature and low humidity, which cause flower and fruit abscission and malformed fruits leading to low seed yield and quality [1]. The variation in quality of seed that produced from different locations can be related to the part of differences in growth habit, reproduction and partly adaptability of genotype to the environmental conditions under which crop was grown [2]. Therefore, selection of suitable provenance for seed production becomes an integral part of seed programme. The present study aims to evaluate the suitability of different locations for getting better growth, flowering, maximum seed yield and quality in chilli.

### MATERIAL AND METHODS

A field experiment was conducted during *kharif* season of 1998-99 and 1999-2000 at the Agricultural Research Station, Annigeri, Agricultural Research Station, Hanumanamatti and Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. It consisted of six treatment combinations, comprising of three locations of production as one factor viz., Dharwad (L<sub>1</sub>), Annigeri (L<sub>2</sub>) and Hanumanamatti (L<sub>3</sub>) and two varieties of chilli as another factor viz., Byadagi kaddi (V<sub>1</sub>) and Dyavanur local (V<sub>2</sub>) and laid out in randomized block design with four replications. The Breeder seed of Byadgi kaddi and Dyavanur local chilli were obtained from the Junior Breeder, ARS, Hanumanamatti. The raised seedbed of 2.5 m length x 1.2m width and 15cm high were prepared for raising the seedlings. Each bed was applied with 30kg well decomposed farm-yard manure and 500g of 15:15:15 complex fertilizer and mixed thoroughly in the soil before sowing.

The seeds were treated with 2g captan per kg of seed and sown on raised seedbed in the lines, then covered with paddy straw and watered to get proper seed germination. The seed beds were watered regularly during evening hours, till the seedlings were ready for transplanting. Two sprays of endosulphan (2ml/litre of water) was given at 10 and 20 days after sowing and third spray of monocrotophos (1 ml/litre of water) was given before two days of transplanting. The seedlings were allowed to grow up to 30 days in the nursery, then the transplanting was done in the main field. The main experimental plot was prepared to fine tilth. The recommended dose of 100:50:50 kg NPK per ha was applied in the form of urea, single super phosphate and muriate of potash, respectively. Half of the nitrogen (50kg/ha) and entire quantity of phosphorus and potash were applied at the time of transplanting. The fertilizers were applied in the form of ring around the plant. The remaining half quantity of nitrogen (50kg/ha) was applied six weeks after transplanting. The transplanting was done by planting one healthy seedling per hill with a distance of 75 cm between the rows and 60cm within the row. Four inter cultivations was taken at third, fifth, seventh and ninth week after transplanting along with three hand weedings. Necessary plant protection measures were taken as and when required to control pests and diseases. The biometric observations on growth, yield and its components and seed quality parameters were recorded at and after harvesting of the crop. The data on these parameters were statistically analysed and presented in Table 1 and 2.

## RESULTS AND DISCUSSION

Chilli is most sensitive to environmental hazards, like high temperature and low humidity, which lead to bud, flower, fruit abscission and malformed fruits resulting in low yield and quality [3 & 1]. Variation in growth, seed yield and quality of chilli that exist due to locations can be related to the difference in habit of growth and reproduction and partly to adaptability of the genotype to the environmental condition under which the crop is grown. The study on provenance was conducted at Dharwad, Hanumanamatti and Annigeri. Dharwad is situated in northern transitional zone

of Karnataka (Zone-8) with an altitude of 678 m above mean sea level and average rainfall of 539.2 mm. Hanumanamatti is located in northern transitional zone of Karnataka (Zone-8) with an altitude of 594.36 m above mean sea level and average rainfall of 270 mm. Annigeri is situated in northern dry Zone of Karnataka (Zone-3), with an altitude 625.80 m above mean sea level and average rainfall of 642 mm. The soils were deep black at Dharwad, while red soil at Hanumanamatti and medium black at Annigeri. This indicate the variations in the weather and soil condition in the locations related for the study.

Significantly, maximum height (89.96 cm), number of primary (5.40) and secondary branches (10.95) per plant, days to 50 per cent flowering (47.70), days to maturity (111) were observed at Dharwad followed by Annigeri and Hanumanamatti location. Maximum seed yield and its contributing components viz., fruit length (14.96 cm), fruit girth (1.01 cm), number of fruits per plant (109.63), fruit weight (1.33 g), pericarp weight (0.80 g), fruit yield per plant (86.83 g), fruit yield (1468 kg/ha), seed yield (512.40kg/ha), number of seeds per fruit (80.44), seed weight per fruit (0.49 g) and 1000 seed weight (5.56 g) were recorded at Dharwad followed by Annigeri and the lowest in Hanumanamatti location (Table 1).

The maximum seed quality parameters viz. germination (89.70%), field emergence (84.70%), root length (9.90 cm), shoot length (9.20 cm), seedling dry weight (22.0 mg), vigour index (1716) and lower electrical conductivity of seed leachate ( $1.50 \text{ dS m}^{-1}$ ) were recorded at Dharwad followed by Annigeri and the lowest seed quality attributes in Hanumanamatti location (Table 2).

The variation in weather parameters and soil conditions of the locations where the experiment was conducted was responsible for variations in growth, seed yield and quality of chilli seeds. Dharwad is located in northern transitional Zone-8, which receives well distributed rainfall from June to October, that coincides with the transplanting of chilli, its grand growth period, formation and development of chilli fruits. The favourable climatic conditions such as temperature (26.8 to 30.4°C) and relative humidity (63.79%) varied at Dharwad during crop growth period. Such provenance effect

Table 1. Influence of provenance on growth, seed yield and its components of chilli

	Plant height (cm)	Pri- mary br/ plant	Sec- ondary br/ plant	Days to 50% flower- ing	Days to matu- rity	Fruit length (cm)	Fruit girth (cm)	No. of fruits/ plant	Fruit wt. (g)	Fruit yield/ plant (kg/ha)	Fruit yield (kg/ha)	No. of seeds/ fruit	Seed wt./ fruit (g)	1000 seed wt. (g)	Pericarp wt. (g)
<b>Varieties (V)</b>															
Byadagi kaddi (V <sub>1</sub> )	92.21	5.62	10.83	43.1	103.3	15.86	0.84	109.50	1.09	81.57	1348	66.62	0.39	4.85	0.68
Dyavanur local (V <sub>2</sub> )	82.91	4.70	9.82	46.4	110.1	12.60	1.16	91.08	1.29	73.83	1227	81.50	0.48	5.49	0.78
S.Em±	0.95	0.15	0.23	0.6	0.7	0.30	0.02	2.21	0.02	1.44	21.00	0.98	0.01	0.03	0.03
CD at 5%	2.86	0.45	0.69	1.9	2.2	0.90	0.06	6.65	0.51	4.33	63.00	2.95	0.03	0.09	0.09
<b>Location (L)</b>															
Dharwad (L <sub>1</sub> )	89.96	5.40	10.95	47.7	111.0	14.96	1.01	109.63	1.33	86.83	1468	80.44	0.49	5.56	0.80
Annigeri (L <sub>2</sub> )	83.75	4.85	9.55	41.7	105.7	13.59	0.93	86.12	1.09	62.21	1031	71.08	0.40	4.87	0.70
Hanumanmatti (L <sub>3</sub> )	88.96	5.23	10.46	44.8	103.5	14.14	1.06	105.13	1.15	84.06	1364	70.66	0.41	5.08	0.70
S. Em±	0.78	0.12	0.18	0.5	1.5	0.25	0.02	1.80	0.01	1.17	17.00	0.80	0.08	0.02	0.02
CD at 5%	2.35	0.36	0.54	1.5	1.7	0.75	0.05	5.42	0.42	3.52	52.00	2.41	0.24	0.06	0.06
<b>Interactions (VxT)</b>															
V <sub>1</sub> L <sub>1</sub>	95.53	6.03	11.60	44.2	109.0	16.30	0.82	123.50	1.25	90.81	1531	67.88	0.46	5.23	0.75
V <sub>1</sub> L <sub>2</sub>	87.28	5.15	9.75	40.7	100.0	15.88	0.80	90.50	9.05	63.83	1060	64.28	0.31	4.54	0.62
V <sub>1</sub> L <sub>3</sub>	93.88	5.66	11.13	44.5	101.0	15.40	0.90	114.50	1.11	90.80	1452	67.70	0.40	4.78	0.67
V <sub>2</sub> L <sub>1</sub>	84.40	4.78	10.30	51.2	113.0	13.63	1.20	95.75	1.41	82.84	1405	93.00	0.52	5.90	0.85
V <sub>2</sub> L <sub>2</sub>	80.23	4.55	9.35	42.7	111.5	11.30	1.07	81.75	1.27	60.59	1002	77.88	0.48	5.20	0.77
V <sub>2</sub> L <sub>3</sub>	84.10	4.78	9.80	45.2	106.5	12.89	1.22	95.75	1.19	78.05	1275	73.63	0.42	5.38	0.73
S.Em±	1.34	0.21	0.32	0.8	1.0	0.43	0.03	3.12	0.03	2.03	30.00	1.39	0.01	0.04	0.04
CD at 5%	NS	NS	NS	NS	3.1	NS	NS	9.40	0.78	6.11	90.00	4.18	0.04	0.12	0.11

NS - Non Significant

on growth, seed yield and quality was recorded [4] in peas, [5] in maize, [6] in chilli and bell pepper [7] evaluated 90 chilli genotypes at two locations and observed variation in growth and yield attributes.

The reduction in growth parameters, early flowering and maturity, lower seed yield and its attributes and seed quality at Hanumanamatti may be due to existence of uneven distribution and lower average annual rainfall, temperature and humidity during the crop growth period. Whereas moderate conditions of temperature and relative humidity were recorded at Annigeri.

#### Varietal performance

The role of heredity in determining the growth, development, flowering, seed yield and quality of chilli is evident from the wide varietal difference. Even at the same location, the seed quality of varieties may be different because of differences in their maturity. Varieties differ because of their different genetic makeup which influence growth, seed yield and quality differently.

Byadagi kaddi variety recorded significantly maximum height (92.21 cm), number of primary (5.62) and secondary branches (10.83), early in 50 per cent flowering (43.10) and maturity (103.30)

Table 2. Influence of provenance on seed quality of chilli

	Germination (%)	Field emergence (%)	Root length (cm)	Shoot length (cm)	Vigour index	Seedling dry wt. (mg)	Electrical conductivity of seed leachate (dSm <sup>-1</sup> )
<b>Varieties (V)</b>							
Byadagi kaddi (V <sub>1</sub> )	89.4(71.06)*	84.0(66.51)*	9.8	9.03	1694	21.8	1.4
Dyavanur (V <sub>2</sub> )	89.5(71.23)	53.7 (66.26)	9.3	8.77	1630	21.1	1.9
S.Em±	0.57	0.45	0.09	0.07	14.00	0.33	0.0
CD (P=0.05%)	NS	NS	0.27	0.21	42.00	NS	0.0
<b>Location (T)</b>							
Dharwad (L <sub>1</sub> )	89.7(71.41)	84.7 (67.04)	9.9	9.21	1716	22.0	1.5
Annigeri (L <sub>2</sub> )	88.6 (70.23)	83.3 (65.96)	9.5	8.51	1605	21.3	1.8
Hanumanmatti (L <sub>3</sub> )	90.1 (71.71)	83.6(66.16)	9.3	8.96	1665	21.2	1.6
S. Em±	0.46	0.37	0.08	0.06	11.00	0.27	0.0
CD (P=0.05%)	1.38	1.11	0.24	0.18	33.00	NS	0.0
<b>Interactions (VxT)</b>							
V <sub>1</sub> L <sub>1</sub>	90.2(71.85)	84.5 (66.83)	10.2	9.35	1766	22.5	1.1
V <sub>1</sub> L <sub>2</sub>	87.7 (69.53)	83.2 (65.85)	9.6	8.63	1604	21.4	1.6
V <sub>1</sub> L <sub>3</sub>	90.2(71.82)	84.5 (66.85)	9.5	9.10	1713	21.7	1.5
V <sub>2</sub> L <sub>1</sub>	89.2 (70.97)	85.0 (67.24)	9.6	9.08	1667	21.5	1.8
V <sub>2</sub> L <sub>2</sub>	89.5(71.12)	83.5 (66.70)	9.4	8.40	1606	21.2	2.0
V <sub>2</sub> L <sub>3</sub>	90.0(71.61)	82.7 (65.48)	9.1	8.83	1617	20.7	1.8
S.Em±	0.81	0.64	0.13	0.10	19.00	0.47	0.0
CD (P=0.05%)	NS	NS	NS	0.30	58.00	NS	0.1

\*Figures in the parantheses indicate arc sine transformed values; NS - Non-significant

over Dyavanur local (Table 1). Significantly maximum fruit yield (1348 kg/ha) and seed yield (498.40 kg/ha) in Byadagi kaddi may be due to the contribution of fruit and yield attributing characters viz., maximum fruit length (15.86 cm), maximum number of fruits (109.50) and maximum fruit yield (81.57 g) per plant.

Superior seed quality parameters were recorded in Byadagi kaddi variety compared to Dyavanur local. Significantly maximum root length (9.80 cm), shoot length (9.0 cm), seedling dry weight (21.8 mg), vigour index (1694) and lower electrical conductivity of seed leachate (1.46 dSm<sup>-1</sup>) were observed in Byadagi kaddi over Dyavanur local.

Variation in growth, seed yield and its components and seed quality parameters between two varieties under study was observed. Such variation in varietal performance was reported in vegetables [8], in peas [4], in chilli and bell pepper [6].

Byadagi kaddi variety at Dharwad location recorded significantly maximum plant height (95.53 cm), primary (6.03) and secondary branches (11.60) per plant, early flowering (44.20 days) and maturity (109 days) compared to Dyavanur local at the same or different location (Hanumanamatti and Annigeri). Maximum fruit yield (1531 kg/ha) and seed yield (556.20 kg/ha) were recorded in Byadagi kaddi at Dharwad location over Dyavanur local. Significant increase in fruit and seed yield of Byadagi kaddi may be due to the contribution of maximum values of yield components viz., number of fruits (109.50/plant), fruit length (16.30 cm), number of fruits (123.50/plant) and fruit yield (90.81 g/plant).

Significantly, maximum shoot length, vigour index (1766) and lower electrical conductivity of seed leachate (1.14 dSm<sup>-1</sup>) were observed in Byadagi kaddi over Dyavanur local. The significantly maximum growth, yield and its components and seed quality parameters in Byadagi kaddi variety at Dharwad location over Dyavanur local may be due to better adaptability and full expression of genetic traits, as Dharwad has favourable climatic conditions like well distributed rainfall, optimum temperature and relative humidity and good soil

conditions might have favoured the genotype like Byadagi kaddi for its better performance compared to other locations. This is in agreement with the reports of Anand *et al.* [6], who observed the differential response of bell pepper and chilli to high temperature conditions [9] in sweet pepper.

From the above discussion, it is clear that Byadagi khaddi variety performed better at Dharwad location compared to Dyavanur local. Among the provenances, Dharwad is the best location for chilli seed production under rainfed condition compared to Annigeri and Hanumanamatti.

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