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Effect of intercropping, nitrogen substitution through organics and graded levels of potassium on the quality, oleoresin content and yield of the bydagi chilli

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Abstract

A field experiment on was conducted during 2009 and 2010 to study the effect of intercropping, organic source of nitrogen substitution and graded levels of Potassium on the quality and oleoresin content of the bydagi chilli. The main treatment consisted of garlic and coriander intercropping and sole chilli and sub treatments consisted of five N substitution and graded levels of K *viz*., S1: $N_0P_{50}K_{100}$ (entire N through organics), S2: $N_{25}P_{50}K_{75}$ (75% N substitution through organics), S3: $N_{50}P_{50}K_{50}$ (50% N substitution through organics), S4: $N_{75}P_{50}K_{25}$ (25% N substitution through organics), S5: $N_{100}P_{50}K_0$ (No substitution). Chilli + garlic intercropping system increased the dry chilli yield to the extent of 11.1 and 30 per cent and chilli equivalent yield to the extent of 57 and 48 per cent over chilli + coriander intercropping system and sole chilli. The yield attributes were also improved under garlic intercropping over sole chilli and chilli+ coriander intercropping system. The quality parameters such as oleoresin content and oleoresin yield, Ascorbic acid content, capsaicin content and Scovielle heat unit increased with chilli + garlic intercropping system compared to the chilli + coriander intercropping system and sole chilli.

Keywords: Intercropping, organics, graded K, Scovielle heat unit, ascorbic acid content, capsaicin content

Introduction

Chilli (*Capsicum annuum* L.), a tropical and subtropical crop, is one of the major vegetable and spice crops grown in the country. It is an essential ingredient of Indian curry, which is characterized by tempting colour, titillating pungency and also having the medicinal value for the crop. The crop is also having the pharmaceutical value. Both as green and dry, chilli is used as paste (both green and red), powder and as whole or in broken/split form. Chilli is a fascinating spice with two important commercial qualities. Some varieties are famous for red colour because of the pigment capsanthin, and others are known for biting pungency attributed by capsaicin. India is the only country wherein a large number of varieties of chilli are grown. Country earns tremendous foreign exchange from the export of spice chilli, oleoresin of low, medium or high pungency, and chilli powder.

India is the largest producer of chilli crop, grown on an area of 2, 68,000 ha with an annual production of 3, 21,000 tonnes with the productivity of 1198 kg ha^{-1}. Karnataka ranks second in area (89,556 ha) and production (1, 11,547 tonnes) of dry chilli after Andhra Pradesh (Anon, 2016) [1].

The current productivity levels are, however, far below the satisfactory level to meet even the domestic demand particularly due to poor nutrient management, viral diseases and the ravages caused by insect pests. In the recent years there is lot of awareness and preference for organically produced food stuffs in the country. Both Government of India and Government of Karnataka have been earmarking significant amount of funds for popularizing organic farming techniques, especially in consumable crops. There is also tremendous demand for organic chilli especially cv. *Bydagi* in recent years. Apart from that, soil health and ecological balance are of paramount importance in switching over to organic farming from chemical based conventional agriculture. In this context use of organics like poultry manure, Vermicompost and neem cake and polycropping (intercropping) need consideration.

Materials and methods

A field experiment was conducted at the Agricultural Research Station, Devihosur, Haveri, UAHS, Bagalkot during growing seasons of 2009-10 and 2010-11 at fixed site using spilt plot design with three replications. The main treatment were garlic and coriander intercroppings and sole chilli and sub-plot treatments were five levels of N substitution through organics coupled with graded levels of K *viz.*, S1- $N_0P_{50}K_{100}$ (entire N through organics), S2-$N_{25}P_{50}K_{75}$ (75 % N substitution through organics), S3-$N_{50}P_{50}K_{50}$ (50 % N substitution through organics), S4-$N_{75}P_{50}K_{25}$ (25 % N substitution through organics) and S5- $N_{100}P_{50}K_0$ (entire inorganic N). Local varieties of coriander and garlic sown in between two chilli rows. The soil was medium deep black (7.2 pH) with medium fertility. The available nitrogen, phosphorus and potassium were 272.0, 36.6 and 336.0 kg ha^{-1}, respectively. The organic carbon content of the soil was 0.56 per cent. The design of the experiment was split plot with three replications. The gross plot size was 7.2 m x 4.8 m and net plot size was 6.0 m x 3.6 m with the spacing of 60 cm x 60 cm. For the estimation of quality parameters samples of red ripe fruits from all pickings were collected treatment-wise for determining quality traits. They were sun dried for 10-15 days till they were brittle and then distilled carefully. The sun dried fruits were used for the analysis of capsaicin and oleoresin. For the estimation of the ascorbic acid content freshly harvested green chilli was used for ascorbic acid estimation. It was determined volumetrically by reducing 2, 6-dichlorophenol-indophenol dye to get a pink end point (Sadasivam and Manikam, 1992) [8]. The Capsaicin content and Scovielle Heat Unit (SHU) was estimated by the procedure proposed by Palacio (1977) [6]. In this estimation procedure, 2 grams of ground-dried chilli was passed through No.40 sieve (0.42 mm) and was placed in the 100 ml volumetric flask. The material was diluted with ethyl acetate up to 100 ml and allowed it to stand for 24 hours to extract. One ml of the extract was taken and diluted with 5 ml of ethyl acetate just before reading, and then 0.5 ml of vanadium oxytrichloride ($VoCl_3$) solution (0.5% $VoCl_3$ in ethyl acetate) was added and the volumetric flask (100 ml) was shaken thoroughly and reading was taken at 720 nm. Then reading was subtracted from the value obtained with 0.5 ml $VoCl_3$ added to 5 ml ethyl acetate (blank) and the reading was compared with the standard curve prepared for capsaicin. The amount of capsaicin in the samples was expressed in percentage. The capsaicin content in fruits is expressed in terms of Scovielle heat units (Scovielle, 1912) [10]. Suzuki *et al.* (1957) [11] have established the relationship that one per cent of pure capsaicin has a Scovielle heat value of 150000 units

$$\%\ \text{capsaicin} = \frac{\text{mg capsaicin}}{1000 \times 1000} \times \frac{100}{1} \times \frac{100}{2}$$

The Oleoresin content was estimated by taking ten grams of chilli powder sample in a chromatographic column, plugged with stop cock. Fifty ml of acetone was added and allowed over night. The slurry was collected in a pre-weighed beaker and solvent was evaporated over a water bath. The collected slurry was cooled and weighed. Difference in weight over sample weight was expressed as per cent oleoresin (AOAC, 1997) or (ASTA method 2.3). Oleoresin yield per ha was worked out by using the formula.

Oleoresin yield (kg ha^{-1}) =

$$\underset{(\text{kgha}^{-1})}{\text{Fruit yield}} - \underset{\text{weight (kg ha}^{-1})}{\text{discoloured fruit}} \times \frac{\text{Oleoresin per cent in fruits}}{100}$$

Results and discussion

The chilli + garlic cropping system recorded the highest chilli equivalent yield (1260 kg ha^{-1}) compared to sole chilli and chilli + coriander cropping systems. The increase in equivalent yield in the chilli + garlic cropping system was to the tune of 57 and 48 per cent over coriander intercropped under chilli and sole chilli system respectively (Table 1). Similar results of increase in chilli equivalent yield with growing of chilli and onion as mixed crop along with cotton and without any reduction in the yield of intercrop (cotton) as compared to that of sole Varalaxmi cotton were reported earlier by Kumaraswamy and Hosamani, 1978 [5]. Elangovan *et al.* (1982) [2] reported the highest chilli yield with solid row planting of chilli with one/three rows of onion. Apart from yield performance, quality of chilli also recorded significant improvement under garlic intercropping system. Similar results of increase in yield with 50/75 kg K_2O with recommended N application was reported by Jeyraman and Balasubramanian (1988) [3] and Ukey *et al*. (1998) [13] and Mallapur *et al.* (2003) [4].

Oleoresin per cent was the highest with chilli + garlic (13.16%) cropping system and other systems were next in the order. Oleoresin per cent with entire nitrogen through organics + 100 kg K_2O per hectare (S_1) was the highest (14.48%) and the values decreased with increase is inorganic N and decrease in potassium, reaching the lowest value with S_4 and S_5 (11.54% and 10.98%, respectively). Oleoresin yield was the highest with garlic intercrop (104 kg ha^{-1}) while, it was the lowest under coriander intercrop. The interaction effect showed that oleoresin per cent was highest (14.88%) with chilli intercropped with garlic receiving no inorganic nitrogen and highest level of K (I_1S_1). The same system receiving $N_{25}P_{50}K_{75}$ (I_1S_2) and chilli intercropped with coriander under similar fertilization (I_2S_2) and sole chilli (I_0S_0) with no inorganic nitrogen were statistically at par. On the other hand, chilli intercropped with coriander receiving entire N in the inorganic form and no K recorded significantly lower oleoresin per cent. Other treatment combinations were in between (Table 3).

Oleoresin yield was the highest with garlic intercrop (104 kg ha^{-1}) while, it was the lowest under coriander intercrop. Among the graded levels of fertilizers oleoresin yield was higher and comparable with S_2 and S_3. While, $N_{100}P_{50}K_0$ recorded the lowest oleoresin yield (61.9 kg ha^{-1}). Chilli intercropped with garlic receiving equal to more than 25 kg N and equal to more than 50 kg K_2O recorded the highest oleoresin yield among all the treatment combinations (127.6 and 130.4 kg ha^{-1} with I_1S_2 and I_1S_3, respectively) (Table 3). On the other hand, under coriander intercrop oleoresin yield of B*ydagi* chilli supplied with $N_{100}P_{50}K_0$ was significantly lower (52.9 kg ha^{-1}). While I_2S_4 and I_0S_5 were at par with the former treatment combination (I_2S_2).

The ascorbic acid content of green chilli fruit did not differ significantly due to intercrop (it ranged from 224 to 226.9 mg 100 g^{-1}), however, it varied significantly due to N substitution, graded levels of K and the interaction effects. Among the fertilizer treatments, with increase the inorganic nitrogen application, the ascorbic acid content decreased and recorded significantly lower value (185.5 mg 100 g^{-1}) with 100 per cent inorganic N coupled with lowest potassium application ($N_{100}P_{50}K_0$). While, the highest ascorbic acid content (266.8 mg 100 g^{-1}) was observed with 100 per cent organic N (zero inorganic N) coupled with highest potassium nutrition ($N_0P_{50}K_{100}$). Among the interactions significantly higher ascorbic acid (272.7 mg 100 g^{-1}) content was observed with chilli + garlic intercropping system nutritioned with zero level of inorganic N (100% organic N) coupled with highest dosage of potassium nutrition (I_1S_1), while it was on par with the treatment combination consisted of all the chilli based cropping systems fertilized with lower level of inorganic N coupled with higher level of potassium application (I_0S_1, I_0S_2, I_1S_2, I_2S_1 and I_2S_2). While, the lowest ascorbic acid content (183.4 mg 100 g^{-1}) was observed with chilli + coriander intercropping system fertilized with 100 per cent inorganic N coupled with zero level of potassium (I_2S_5) (Table 2). In general, ascorbic acid content decreased with increase in the inorganic N application in the chilli based cropping systems evaluated. Similar results of increase in ascorbic acid content and other quality parameters with lower level of inorganic N coupled with higher level of organic sources of N was reported by Popokaya (1957) [7]. Sinha (1975) [9] in Kashmir variety of chilli and Uddin and Begum (1990) [12] in capsicum reported that inorganic N given alone or in combination with other nutrients had negative effect on vitamin C ascorbic acid content of the chilli.

Among the intercrops, capsaicin content of chilli fruits did not differ significantly (it ranged from 0.15% to 0.13%). While, significant variations were observed with N substitution, graded levels of K fertilization and due to interaction. Among the fertilizer treatments, capsaicin content of the chilli fruits increased significantly with decrease in the inorganic N fertilization recording significantly higher value (0.18%) with lowest (zero) level of inorganic N application coupled with highest level of potassium nutrition ($N_0P_{50}K_{100}$). While, it was on par with $N_{25}P_{50}K_{75}$ nutrient application (0.16%). The lower capsaicin content (0.10%) was recorded with highest level of inorganic N application coupled with zero potassium application ($N_{100}P_{50}K_0$) and S_4 was at par. Among the treatment combinations, chilli + garlic intercropping system nutritioned with lowest level of inorganic N (100% organic N source) with higher potassium application (I_1S_1) recorded significantly higher capsaicin (0.19%). While, it was on par with the treatment combinations consisted of all the chilli based cropping system fertilized with lower level of inorganic N with higher level of potassium (I_0S_1, I_0S_2, I_1S_2, I_2S_1 and I_2S_2 treatment combinations). The lowest capsaicin content (0.09%) was recorded with sole chilli fertilized with highest level of inorganic N coupled with zero potassium application (I_0F_5) (Table 2).

The SHU differed significantly due to intercrops, N substitution, graded levels of K and due to interaction. Among the intercrops, chilli + garlic intercropping system recorded highest SHU, while sole chilli and chilli + coriander were at par with each other. As for the graded levels of N and K, highest SHU (26080) were recorded with the treatment receiving entire nitrogen in organic form and 100 kg ha^{-1} K_2O. On the other hand, treatment receiving 75 kg ha^{-1} or more of inorganic nitrogen and ≤ 25 kg K_2O recorded significantly lower Scovielle heat units (S_4 and S_5). Among the treatment combinations, chilli intercropped with garlic receiving only organic form of nitrogen and highest level of K (I_1S_1) recorded significantly higher SHU (28500). I_1S_2, I_1S_3 and I_2S_1 were at par with the former treatment, while, $N_{100}P_{50}K_0$ and $N_{75}P_{50}K_{25}$ recorded lower SHU irrespective of the cropping system (Table 2).

Per cent discoloured fruits were significantly lower in chilli intercropped with garlic (11.78%) than in other systems. Among the graded fertilizer treatments, percentage discoloured fruits were significantly lower when the fertilizer N applied was minimum or zero and potassium equalled or exceeded 75 kg ha^{-1} (11.10 and 11.56 with $N_0P_{50}K_{100}$ and $N_{25}P_{50}K_{75}$, respectively). On the other hand, when the inorganic form of nitrogen was 75 kg or more with corresponding variation in potassium from 25 to 0, the per cent discoloured fruits increased, the maximum 13.93 and 14.45 per cent were recorded with S_4 and S_5, respectively. Among the treatment combinations, per cent discoloured fruits were highest (15.38%) with sole chilli receiving highest level of inorganic nitrogen (I_0S_5) (Table 4). However, same fertilizer combination under chilli + garlic recorded significantly lower percentage of discoloured fruits, while it was not to the same extent in chilli + coriander. Both the intercropping systems receiving lower level of inorganic nitrogen and higher levels of potassium fertilizers recorded lower percentage of discoloured fruits.

Table 1: Yield and equivalent yield (kg ha^{-1}) of bydagi chilli (*dabbi*) as influenced by intercropping, N substitution and graded levels of K

Treatments	Yield (kg ha^{-1})			Chilli equivalent yield (kg ha^{-1})		
	2005-06	2006-07	Pooled	2005-06	2006-07	Pooled
Intercropping						
I_0: Sole chilli	741^{a}	861^{b}	801^{b}	742^{b}	861^{b}	801^{b}
I_1: Chilli+Garlic	809^{a}	971^{a}	890^{a}	1178^{a}	1342^{a}	1260^{a}
I_2: Chilli+Coriander	634^{b}	768^{c}	701^{c}	779^{b}	922^{b}	850^{b}
S.Em.±	30.0	29.1	20.9	29.6	32.1	21.8
LSD (0.05)	87.4	84.9	59.4	86.3	93.6	62.1
N substitution and graded levels of K						
S_1: N_0:P_{50}:K_{100}	633^{cd}	779^{cd}	706^{c}	791^{cd}	952^{cd}	872^{c}
S_2: N_{25}:P_{50}:K_{75}	815^{ab}	940^{ab}	878^{ab}	996^{ab}	1131^{ab}	1063^{a}
S_3: N_{50}:P_{50}:K_{50}	873^{a}	1020^{a}	947^{a}	1061^{a}	1215^{a}	1137^{a}
S_4: N_{75}:P_{50}:K_{25}	744^{bc}	872^{bc}	808^{b}	896^{bc}	1036^{bc}	966^{b}
S_5: N_{100}:P_{50}:K_0	577^{d}	723^{d}	650^{c}	752^{d}	875^{d}	814^{c}
S.Em.±	38.7	37.5	27.0	38.2	41.4	28.2
LSD (0.05)	112.8	109.6	76.6	111.4	120.8	80.4
Interaction						
I_0S_1	632^{de}	811^{c-f}	722^{e-i}	632^{g}	811^{fg}	722^{ghi}
I_0S_2	818^{abcd}	919^{b-e}	869^{b-e}	818^{defg}	919^{d-g}	869^{e-g}
I_0S_3	862^{abc}	953^{bc}	908^{bc}	862^{def}	953^{d-g}	908^{ef}

I_0S_4	794^{bcd}	898^{b-e}	846^{b-f}	794^{efg}	898^{d-g}	846^{e-h}
I_0S_5	602^{de}	725^{def}	664^{ghi}	602^{g}	725^{g}	664^{i}
I_1S_1	662^{cde}	826^{c-f}	744^{d-h}	999^{cde}	1192^{bc}	1096^{bc}
I_1S_2	907^{ab}	1094^{ab}	1001^{ab}	1292^{ab}	1494^{a}	1393^{a}
I_1S_3	1028^{a}	1221^{a}	1125^{a}	1422^{a}	1628^{a}	1525^{a}
I_1S_4	820^{abcd}	931^{bcd}	875^{bcd}	1146^{bc}	1280^{b}	1213^{b}
I_1S_5	628^{de}	787^{c-f}	708^{f-i}	1030^{cd}	1117^{bcd}	1073^{bcd}
I_2S_1	604^{de}	701^{ef}	653^{hi}	742^{fg}	852^{efg}	797^{fghi}
I_2S_2	720^{bcde}	808^{c-f}	764^{c-h}	880^{def}	981^{c-f}	930^{def}
I_2S_3	729^{bcd}	887^{b-e}	808^{c-g}	898^{def}	1063^{b-e}	981^{cde}
I_2S_4	618^{de}	786^{c-f}	702^{f-i}	749^{fg}	929^{d-g}	839^{e-h}
I_2S_5	502^{e}	657^{f}	580^{i}	624^{g}	783^{fg}	704^{hi}
S.Em.±	67.0	65.0	46.7	66.1	71.7	48.9
LSD (0.05)	195.4	189.8	132.7	192.9	209.3	138.9
C.V. (%)	16.0	13.0	14.4	12.7	11.9	12.4

Note: Crop was supplied with 100 kg N ha^{-1} in inorganic and/or organic form; N base figures indicate N substitution with inorganics only. In a column means followed by the same alphabet do not differ significantly by DMRT (0.05)

Table 2: Ascorbic acid content (mg 100 g^{-1}), capsaicin content (%) and Scovielle heat units of bydagi chilli

Treatments	Ascorbic acid content (mg 100 g^{-1})			Capsaicin content (%)			Scovielle heat units		
	2005-06	2006-07	Pooled	2005-06	2006-07	Pooled	2005-06	2006-07	Pooled
Intercropping									
I_0: Sole chilli	219.7^{a}	228.2^{a}	224.0^{a}	0.11^{b}	0.14^{a}	0.13^{a}	16600^{b}	21300^{b}	18950^{b}
I_1: Chilli+Garlic	224.9^{a}	239.2^{a}	232.0^{a}	0.14^{a}	0.16^{a}	0.15^{a}	20900^{a}	24400^{a}	22650^{a}
I_2: Chilli+Coriander	220.4^{a}	233.3^{a}	226.9^{a}	0.12^{ab}	0.16^{a}	0.14^{a}	17400^{b}	24100^{ab}	20750^{b}
S.Em.±	6.90	4.50	4.1	0.01	0.01	0.01	907	978	667
LSD (0.05)	NS	NS	NS	0.02	NS	NS	2650	2855	1897
N substitution and graded levels of K									
S_1: N_0:P_{50}:K_{100}	257.1^{a}	276.5^{a}	266.8^{a}	0.16^{a}	0.19^{a}	0.18^{a}	23670^{a}	28500^{a}	26080^{a}
S_2: N_{25}:P_{50}:K_{75}	243.0^{a}	258.3^{b}	250.6^{b}	0.14^{a}	0.17^{a}	0.16^{ab}	21500^{ab}	25500^{a}	23500^{b}
S_3: N_{50}:P_{50}:K_{50}	231.0^{a}	241.8^{b}	236.4^{b}	0.13^{a}	0.17^{a}	0.15^{b}	19333^{b}	24670^{a}	22000^{b}
S_4: N_{75}:P_{50}:K_{25}	195.2^{b}	202.4^{c}	198.8^{c}	0.10^{bc}	0.13^{b}	0.11^{c}	14500^{c}	19670^{b}	17080^{c}
S_5: N_{100}:P_{50}:K_0	182.1^{b}	188.8^{c}	185.5^{c}	0.08^{c}	0.12^{b}	0.10^{c}	12500^{c}	18000^{b}	15250^{c}
S.Em.±	9.0	5.80	5.3	0.01	0.01	0.01	1172	1263	861
LSD (0.05)	26.1	16.9	15.2	0.03	0.03	0.02	3421	3686	2449
Interaction									
I_0S_1	254.0^{ab}	264.0^{ab}	259.0^{ab}	0.15^{abc}	0.17^{ab}	0.16^{a-d}	21500^{a-d}	25500^{ab}	23500^{bc}
I_0S_2	246.0^{ab}	252.0^{ab}	249.0^{ab}	0.13^{a-d}	0.16^{abc}	0.15^{a-e}	19500^{b-e}	24000^{abc}	21750^{bcd}
I_0S_3	230.0^{a-e}	239.0^{bc}	234.5^{b}	0.12^{a-d}	0.16^{abc}	0.14^{b-f}	18000^{c-f}	24000^{abc}	21000^{cde}
I_0S_4	188.4^{cde}	196.4^{d}	192.4^{c}	0.08^{d}	0.12^{bc}	0.10^{fg}	12000^{f}	18000^{cd}	15000^{f}
I_0S_5	180.1^{e}	189.6^{d}	184.9^{c}	0.08^{d}	0.10^{c}	0.09^{g}	12000^{f}	15000^{d}	13500^{f}
I_1S_1	260.6^{a}	284.8^{a}	272.7^{a}	0.18^{a}	0.20^{a}	0.19^{a}	27000^{a}	30000^{a}	28500^{a}
I_1S_2	244.7^{ab}	266.4^{ab}	255.6^{ab}	0.17^{ab}	0.18^{ab}	0.18^{ab}	25500^{ab}	27000^{ab}	26250^{ab}
I_1S_3	228.4^{a-e}	244.1^{b}	236.3^{b}	0.15^{abc}	0.18^{ab}	0.17^{abc}	22000^{abc}	27000^{ab}	24500^{abc}
I_1S_4	204.8^{b-e}	210.2^{cd}	207.5^{c}	0.11^{bcd}	0.14^{abc}	0.13^{c-g}	16500^{c-f}	20000^{bcd}	18250^{def}
I_1S_5	186.0^{de}	190.4^{d}	188.2^{c}	0.09^{cd}	0.12^{bc}	0.11^{efg}	13500^{ef}	18000^{cd}	15750^{f}
I_2S_1	256.6^{ab}	280.7^{a}	268.7^{a}	0.15^{abc}	0.20^{a}	0.18^{ab}	22500^{abc}	30000^{a}	26250^{ab}
I_2S_2	238.2^{abc}	256.4^{ab}	247.3^{ab}	0.13^{a-d}	0.17^{ab}	0.15^{a-e}	19500^{b-e}	25500^{ab}	22500^{bcd}
I_2S_3	234.6^{a-d}	242.4^{b}	238.5^{b}	0.12^{a-d}	0.16^{abc}	0.14^{f}	18000^{c-f}	23000^{abc}	20500^{cde}
I_2S_4	192.4^{cde}	200.6^{d}	196.5^{c}	0.09^{cd}	0.14^{abc}	0.12^{d-g}	15000^{def}	21000^{bcd}	18000^{def}
I_2S_5	180.3^{e}	186.5^{d}	183.4^{c}	0.08^{d}	0.14^{abc}	0.11^{efg}	12000^{f}	21000^{bcd}	16500^{ef}
S.Em.±	15.5	10.0	9.2	0.02	0.02	0.01	2030	2187	1492
LSD (0.05)	45.3	29.3	26.3	0.05	0.05	0.04	5925	6384	4292
C.V. (%)	12.1	7.4	9.9	18.7	16.9	17.8	19.2	16.3	17.5

(*dabbi*) as influenced by intercropping, N substitution and graded levels of K

Note: Crop was supplied with 100 kg N ha^{-1} in inorganic and/or organic form N base figures indicate N substitution with inorganics. In a column means followed by the same alphabet do not differ significantly by DMRT (0.05)

Table 3: Oleoresin content (%) and oleoresin yield (kg ha^{-1}) of bydagi chilli (*dabbi*) as influenced by intercropping, N substitution and graded levels of K

Treatments	Oleoresin content (%)			Oleoresin yield (kg ha^{-1})		
	2005-06	2006-07	Pooled	2005-06	2006-07	Pooled
Intercropping						
I_0: Sole chilli	12.18^{a}	12.95^{ab}	12.56^{b}	77.85^{b}	97.05^{b}	87.5^{b}
I_1: Chilli+Garlic	12.49^{a}	13.83^{a}	13.16^{a}	89.00^{a}	119.67^{a}	104.3^{a}
I_2: Chilli+Coriander	11.85^{a}	13.07^{b}	12.43^{b}	65.86^{c}	87.96^{b}	76.9^{c}
S.Em.±	0.24	0.27	0.19	3.20	3.85	2.50
LSD (0.05)	NS	0.82	0.53	9.34	11.23	7.12
N substitution and graded levels of K						
S_1: N_0:P_{50}:K_{100}	13.84^{a}	15.11^{a}	14.48^{a}	77.24^{b}	104.6^{ab}	90.9^{b}
S_2: N_{25}:P_{50}:K_{75}	13.27^{a}	14.28^{ab}	13.78^{b}	95.39^{a}	119.64^{a}	107.5^{a}
S_3: N_{50}:P_{50}:K_{50}	12.31^{b}	13.33^{b}	12.82^{c}	93.48^{a}	119.57^{a}	106.5^{a}
S_4: N_{75}:P_{50}:K_{25}	10.81^{c}	12.27^{c}	11.54^{d}	69.27^{b}	92.54^{b}	80.9^{c}
S_5: N_{100}:P_{50}:K_0	10.65^{c}	11.31^{c}	10.98^{d}	52.47^{c}	71.44^{c}	61.9^{d}
S.Em.±	0.31	0.36	0.24	4.13	4.97	3.20
LSD (0.05)	0.92	1.05	0.68	12.06	14.5	9.20
Interaction						
I_0S_1	13.68^{a}	14.84^{ab}	14.26^{ab}	75.5^{bcd}	105.43^{bcd}	90.5^{bc}
I_0S_2	13.12^{ab}	13.77^{abc}	13.44^{bc}	93.31^{ab}	111.23^{bc}	102.3^{b}
I_0S_3	12.64^{a-d}	13.04^{bcd}	12.84^{cd}	94.30^{ab}	107.50^{bcd}	100.9^{b}
I_0S_4	10.80^{ef}	12.05^{cde}	11.43^{efg}	72.48^{bcd}	92.50^{b-e}	82.5^{cde}
I_0S_5	10.60^{f}	11.03^{de}	10.84^{fg}	53.65^{de}	68.56^{ef}	61.1^{fg}
I_1S_1	14.1^{a}	15.65^{a}	14.88^{a}	83.64^{b}	116.03^{b}	99.8^{bc}
I_1S_2	13.64^{ab}	14.82^{ab}	14.23^{ab}	110.50^{a}	144.67^{a}	127.6^{a}
I_1S_3	12.42^{a-e}	13.85^{abc}	13.14^{bcd}	111.50^{a}	149.27^{a}	130.4^{a}
I_1S_4	11.30^{c-f}	12.80^{b-e}	12.05^{def}	80.09^{bc}	104.09^{bcd}	92.1^{bc}
I_1S_5	11.00^{def}	12.05^{cde}	11.53^{efg}	59.25^{cde}	84.29^{c-f}	71.7^{def}
I_2S_1	13.74^{a}	14.85^{ab}	14.30^{ab}	72.59^{bcd}	92.34^{b-e}	82.5^{cde}
I_2S_2	13.04^{abc}	14.27^{ab}	13.65^{abc}	82.35^{bc}	103.01^{bcd}	92.7^{bc}
I_2S_3	11.86^{b-f}	13.11^{bc}	12.48^{cde}	74.64^{bcd}	101.93^{bcd}	88.3^{bcd}
I_2S_4	10.32^{f}	11.95^{cde}	11.14^{fg}	55.24^{de}	81.04^{def}	68.1^{efg}
I_2S_5	10.30^{f}	10.86^{e}	10.58^{g}	44.50^{e}	61.47^{f}	52.9^{g}
S.Em.±	0.97	0.63	0.41	7.16	8.60	5.60
LSD (0.05)	2.82	1.83	1.18	20.89	25.11	15.90
C.V. (%)	7.8	8.2	8.00	16.0	14.7	15.3

Note: Crop was supplied with 100 kg N ha^{-1} in inorganic and/or organic form N base figures indicate N substitution with inorganics. In a column means followed by the same alphabet do not differ significantly by DMRT (0.05)

Table 4: Per cent discoloured fruits of bydagi chilli (*dabbi*) as influenced by intercropping N substitution and graded levels of K

Treatments	Discoloured fruits (%)		
	2005-06	2006-07	Pooled
I_0: Sole chilli	13.99^{a}	13.20^{a}	13.60^{a}
I_1: Chilli+Garlic	12.10^{b}	11.46^{b}	11.78^{b}
I_2: Chilli+Coriander	13.32^{a}	12.52^{a}	12.92^{a}
S.Em.±	0.36	0.34	0.25
LSD (0.05)	1.04	0.98	0.70
S_1: N_0:P_{50}:K_{100}	11.39^{d}	10.80^{d}	11.10^{c}
S_2: N_{25}:P_{50}:K_{75}	11.97^{cd}	11.15^{cd}	11.56^{c}
S_3: N_{50}:P_{50}:K_{50}	13.13^{bc}	12.36^{bc}	12.75^{b}
S_4: N_{75}:P_{50}:K_{25}	14.30^{ab}	13.56^{ab}	13.93^{a}
S_5: N_{100}:P_{50}:K_0	14.90^{a}	14.00^{a}	14.45^{a}
S.Em.±	0.46	0.43	0.32
LSD (0.05)	1.34	1.27	0.90
I_0S_1	12.1^{c-e}	11.82^{bcd}	11.96^{def}
I_0S_2	12.80^{b-e}	12.06^{bcd}	12.43^{cde}
I_0S_3	13.77^{abc}	13.15^{abc}	13.46^{bcd}
I_0S_4	15.40^{ab}	14.10^{ab}	14.75^{ab}
I_0S_5	15.90^{a}	14.86^{a}	15.38^{a}
I_1S_1	10.27^{e}	9.86^{d}	10.06^{g}
I_1S_2	11.00^{de}	10.12^{d}	10.56^{fg}
I_1S_3	11.85^{cde}	11.64^{bcd}	11.75^{d-g}
I_1S_4	13.40^{a-d}	12.70^{abc}	13.05^{b-e}
I_1S_5	14.00^{abc}	12.96^{abc}	13.48^{bcd}
I_2S_1	11.80^{cde}	10.98^{cd}	11.39^{efg}
I_2S_2	12.10^{c-e}	11.27^{cd}	11.68^{d-g}
I_2S_3	13.80^{abc}	12.30^{bcd}	13.05^{b-e}

I_2S_4	14.1[abc]	13.87[ab]	13.98[abc]
I_2S_5	14.80[ab]	14.18[ab]	14.49[ab]
S.Em.±	0.80	0.75	0.55
LSD (0.05)	2.33	2.20	1.56
C.V. (%)	10.5	10.4	10.5

Note: Crop was supplied with 100 kg N ha^{-1} in inorganic and/or organic form N base figures indicate N substitution with inorganics only. In a column means followed by the same alphabet do not differ significantly by DMRT (0.05)

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