Table 2. Nitrogen management and yield of *rabi* rice

Nitrogen Management	Grain yield (kg ha^{-1})		
	1990	1991	Mean
N_1 - 100 kg N ha^{-1} as inorganic	5319	5367	5343
N_2 - 75 kg N as inorganic + Azolla	5402	5360	5381
N_3 - 75 kg N as inorganic + BGA	5337	5167	5252
N_4 - 75 kg N as inorganic + Azolla + BGA	5253	5227	5240
CD (P=0.05)	NS	NS	

Similar results have been reported by Nageswara Reddy and Raju (1987).

Nitrogen management

The results from the study clearly established that the use of azolla or BGA alone or together could help to save 25 per cent of inorganic N without any yield loss (Table 2), in transplanted rice. The yield difference between 100 per cent N through inorganic fertilizer and 75 per cent N + biofertilizer was not significant. The results imply that it is possible to substitiute 25 per cent of inorganic N through the inoculation of azolla or BGA without any loss of yield in transplanted rice.

From the results of the study, it can be recommended that for *rabi* rice in Tambiraparani command area, irrigation can be given immediately after disapperance of ponded water instead of continuous submergence. This practice would save about 29 per cent of irrigation water with only marginal yield reduction. For nitrogen management to *rabi* rice, 75 kg N ha^{-1} through inorganic fertilizer + azolla or BGA inoculation can be recommended for high yield and reduction of inorganic fertilizers by 25 per cent.

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EVALUATION OF CHILLI GERMPLASM FOR CAPSANTHIN AND CAPSAICIN CONTENTS AND EFFECT OF STORAGE ON GROUND CHILLI

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ABSTRACT

The two quality traits *viz* capsanthin and capsaicin contents were determined in 21 and 29 genotypes of chilli (*Capsicum annuum L*) in 1980 and 1981 respectively. Wide variation was observed in both the qualities in 1980 as well as in 1981 after storage of the materials for one year. Capsanthin content ranged from 0.144 to 0.407 per cent and capsaicin from 0.105 to 1.810 per cent in the different genotypes studied in 1980 and in 1981, they ranged from 0.057 to 0.400 and from 0.035 to 1.295 respectively. No correlation between these two quality traits was recorded. The reduction in capsanthin and capsaicin contents was lowest in "Ducale" and "IHR 309-4" genotypes respectively. It is infered that the higher the capsanthin and capsaicin contents in the genotypes, the higher the amount of loss in the storage.

KEY WORDS : Capsanthin, Capsaicin, Chilli, Genotypes, Storage

Chilli (*Capsicum annuum L*) is extensively cultivated in India and is marketed as whole fruit, powder, paste and oleoresin. It is used in cuisines all over the world. Several uses of capsicum have been reported (Bosland, 1992, Smith *et al.*, 1987). Red chilli is dehydrated and from dried pods, red chilli powder is made. The quality of red chilli is based on colour, pungency and retention of these ualities durin storaee. Colour in mature fruits c2. cl) (Hurtado-Hernandez and Smith, 1985). Further, red colour is attributed to the presence of about 20 carotenoids of which capsanthin is the major one. Pungency is another important quality. It is due to the mixture of 7 homologous branded-chain alkyl vanillyl amides namely capsaicinoids (Hoffman *et al.*, 1983) which are produced in glands on the placenta of the fruit. Dried capsicum powder is classified into 5 groups

Table 1. Capsaicin and capsanthin contents in different chilli varieties in 1980 and 1981 and loss in quality due to storage

Genotype	Quality parameters					
	Capsaicin content (%)			Capsanthin content (%)		
	1980	1981	reduction	1980	1981	reduction
IHR 96C-1-3-59 (Ducale)	1.810	0.475	1.335 (73.8)	0.407	0.400	0.007 (1.7)
IHR 263-23-2-1 (G3)	0.575	0.125	0.450 (78.3)	0.257	0.082	0.175 (68.1)
IHR 289 (Assam local)	1.626	1.295	0.331 (20.4)	0.250	0.207	0.043 (17.2)
IHR 298-2 (Sankeshwar)	0.862	0.280	0.582 (67.5)	0.263	0.212	0.051 (19.4)
IHR 299-1-3 (Byadagi Kaddi)	0.502	0.120	0.382 (76.1)	0.270	0.101	0.169 (62.6)
IHR 307-13-3 (Ronyal local)	0.627	0.300	0.327 (52.2)	0.276	0.145	0.131 (47.5)
IHR 310-2 (Byadagi local from Bangalore)	0.532	0.350	0.182 (34.2)	0.320	0.212	0.108 (33.8)
IHR 323 (Gowribidnur local)	1.275	0.515	0.760 (59.6)	0.183	0.145	0.038 (20.8)
IHR 324-16 (red local from Bangalore)	0.708	0.285	0.424 (59.7)	0.205	0.145	0.060 (29.3)
IHR 328-25 (local Anekal)	1.023	0.405	0.618 (60.4)	0.205	0.101	0.104 (50.7)
IHR 332-10 (local from Bengaum)	0.398	0.040	0.358 (90.0)	0.328	0.135	0.193 (58.8)
IHR 344 (Vijayawada local)	1.046	0.195	0.851 (81.4)	0.234	0.091	0.143 (61.1)
IHR 347-14 (Bellary khaddi collection)	0.115	0.055	0.060 (52.2)	0.179	0.145	0.034 (19.0)
IHR 348-4 (Kurnool chilli)	0.830	0.360	0.470 (56.6)	0.252	0.067	0.185 (73.4)
IHR 349-12 (Dabigei chilli)	0.643	0.180	0.463 (72.0)	0.212	0.198	0.014 (6.6)
IHR 352-7 (JCA 232)	0.135	0.035	0.100 (74.1)	0.303	0.067	0.246 (81.2)
IHR 360 (local collection from Varanasi)	0.990	0.410	0.580 (58.6)	0.189	0.130	0.059 (31.2)
IHR 525-5-4-1-3	0.980	0.470	0.510 (52.0)	0.209	0.057	0.152 (72.7)
G 4	0.547	0.360	0.187 (34.2)	0.323	0.111	0.212 (65.6)
IHR 304-3 (DH-7-6-5)	0.531	0.155	0.376 (70.8)			
IHR 306-1 (DH-7-6-12)	0.234	0.195	0.039 (16.7)			
IHR 307-4 (Ronyal local)	0.647	0.290	0.357 (55.2)			
IHR 309-4 (Gowribidnur local)	0.670	0.637	0.033 (4.9)			
IHR 315-1-25 (Sardhana local)	1.707	0.550	1.157 (67.8)			
IHR 327-18 (local var. Kolar)	0.840	0.390	0.450 (53.6)			
IHR 358-30 (Guntur chilli)	0.978	0.250	0.728 (74.4)			
IHR 531-30-1-5	0.785	0.250	0.535 (68.2)			
JCA 154	0.105	0.060	0.045 (42.9)			
Jwala	0.627	0.260	0.367 (58.5)			
IHR 294-3 (Habbegudi local)				0.144	0.130	0.014 (9.7)
IHR 353-27 (JCA 20)				0.238	0.149	0.089 (37.4)
Mean	0.771	0.320		0.250	0.144	

pungent, moderately punjent, highly pungent and very highly pungent (Bosland, 1993). The pungency is due to the genetic make up of the capsaicin. Quality also depends on the retention of these two qualities without deterioration during storage. Improving the quality means improving the cultivars through proper breeding programmes. The study was undertaken with the object of evalution of genotypes for the desired quality traits at the Indian Institute of Horticultural Research, Bangalore.

MATERIALS AND METHODS

During 1980 season, red ripe fruits were harvested from the germplasm maintained and dried in the oven and then the dried chilles were ground in a mixi and sieved through Sieve No.40 and analysed for capsanthin and capsaicin contents following the methods of Woodbury (1977) and Palacio (1977) respectively. Samples of chilli powder were stored under dark conditions at room temperature for one year and analysed again for the quality traits. Care was bestowed in preserving the chilli powder under dark conditions as light would decolourise the red pigments. Loss in quality due to storage was then determined. A total of 21 and 29 genotypes was analysed for capsanthin and capaicin contents respectively as before. Correlation analysis between i) capsanthin and capsaicin contents and ii) capsanthin and capsaicin contents present at maturity and the amount of deterioration after one year of storage was also made.

RESULTS AND DISCUSSION

Variability

Data on capsanthin and capsaicin contents and the amount of loss due to storage for one year are given in Table (1). The capsanthin content exhibited wide variability among the genotypes. It ranged from 0.407 to 0.144 per cent. The maximum of 0.407 per cent was recorded in Ducale followed by IHR 332-10 (0.328) (Belgaum local), G 4 (0.323) and IHR 310-2 (0.320) (Byadagi local) respectively. Such wide variation in carotenoid content among the cultivars and carotenoid componenets was reported by many workers. The reduction due to storage was the least (1.7%) in Ducale followed by 6.6 per cent in IHR 349-12 (Dabigei chilli) and 9.7 per cent in IHR 294-3 352-7 (JCA 232). According to Lease and Lease (1956), the red colour of the powder can be retained if the oxidation of the powder is prevented.

The capsaicin content also exhibited wide variation among the genotypes. It was highest (1.810 %) in Ducale followed by IHR 315- 1-25 (1.707 %) (Sardhana local) and lowest (0.105 %) in JCA 154. The reduction in capsaicin content due to storage was lowest (4.9%) in IHR 309-4 (Gowribidnur local) followed by 20.4 % in IHR 289 (Assam local) and highest (90.0%) in IHR 332-10 (Belgaum local).

The correlation studies between capsanthin and capsaicin contents in 19 varieties showed that there was no correlation between these traits as the correlation coefficient was only 0.078 which was not significant. Highly significant correlation (r = 0.834**) was recorded between capsaicin content and amount of reduction due to storage indicating the inference that the higher the capsaicin content the more the amount of loss due to storage. The correlation coefficient of 0.371 recorded between capsanthin content and amount of reduction in the quality due to storage just failed to reach the level of significant showing the tendency to the existence of positive relationship. The number of entries in this study was only 21 and to confirm the results more studies are needed with more varieties.

The present investigation gave the following results: i) the genotypes namely Ducale, G3, IHR 289 (Assam local) and IHR 298-2 (Sankeshwar) which possess high capsaicin content appear to be the suitable genotypes for increasing the pungency; ii) Ducale, IHR 332-10, G 4 and IHR 310-2 for producing new cultivars with a high colour intensity and iii) there is association between degree of pungency and amount of deteioration during storage and iv) pungency and colour were not related to one another.

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HETEROSIS AND COMBINING ABILITY IN INTERVARIETAL CROSSES OF MAIZE

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ABSTRACT

The combining ability and heterosis were estimated from a number of crosses comprising 10 elite varieties of *Zea mays* L. obtained from diverse geographical regions. 'AB male bulk' was the best general combiner for grain yield and kernel/row. Two single crosses *viz*'AB male bulk x composite V_2 ' and 'Hemant x CIMMYT Pool 23' significantly outyielded the standard check 'Vijay Composite', and the hybrid check 'Deccan 103'. for grain yield. The extent of heterosis over better parent and economic heterosis revealed that crosses which had higher estimates of heterosis for grain yield also exhibited higher estimates of heterosis for the major yield components as well.

KEY WORDS : Maize, Intervarietal Crosses, Heterosis Combining Ability

The criteria for selection of parents for hybridisation is one of the crucial tasks often faced by the plant breeders. It is generally viewed that the selection criteria for grain yield is not only primarily be based on the yield *per se* of the parents but also based on the sound consideration of the estimates of combining ability of the parents to be used as well. This is mainly with the view that only the most desirable and high yielding cross combinations could be quickly picked up from a number of cross combinations available. In meaningful yield improvement programmes, therefore, the understanding of combining ability effect and heterosis over better parent and over the standard checks become essential and *a priori*.

MATERIALS AND METHODS

Ten white materials of maize,*Zea mays* L. ('Laxmi', 'Hemant','M 12', 'M 13', 'AB male bulk','CIMMYT Pool 23','CIMMYT Pool 28','CIMMYT Pool 32', 'Composite V_2' and UPB 742') were selected to represent a wide spectrum of ecogeographic diversity. These elite populations were crossed in a diallel mating system during *kharif* 1985 to obtain 45 F_1 crosses. A total of 59 treatments comprising of ten varieties, their 45 F_1's and four checks *viz.* the hybrid check 'Deccan 103' and three popular variety checks 'Vijay composite', 'Tarun' and 'Janupur variety checks 'Vijay Composite', 'Tarun' and 'Jaunpur Local' were planted in randamised block design with three replications. Each entry was planted in two row plot of five m length with 60 X 25 cm spacing. The data were recorded on days to 50 per cent silking, plant height (cm), ear height (cm), ear length (cm), ear diameter (cm), number of kernel rows/ear, number of kernels per row, thousand grain weight (g) and grain yield/plot (kg). Data related to days to 50 per cent silking and grain yield were recorded on whole plot basis while data relating to other characters were recorded on ten randomly selected plants and were later averaged out. The combining ability analysis was done according to Griffing (1956) methods 2 model I. Heterosis over better partent (heterobeltiosis) and standard cecks (economic heterosis) were estimated as Heterobeltiosis = $\frac{F-BP}{BP}$ x 100 and economic