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HETEROSIS IN HYBRID RICE

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ABSTRACT

Thiry six hybrids were developed utilising three cytoplasmic genetic male sterile lines (V 20 A, IR 58055 A and IR 62829 A) and twelve testers and they were studied for the extent of heterosis on six quantitative characters *viz.*, days to flowering, panicles per plant, grains per panicle, spikelet fertility, 100- grain weight and grain yield per plant. The hybrid IR 62829 A x CO 37 revealed heterotic vigour for panicles per plant and grain yield per plant.

KEYWORDS: Hybrid Rice, Heterosis .

Heterosis has been exploited to a greater degree in cross pollinated crops like maize and pearl millet. It has been recently utilised to self pollinated crops like wheat, rice, tomato, etc. China has convincingly demonstrated that hybrid rice can be developed and exploited commercially (Virmani *et al.*, 1981). Several cytoplasmic genetic male sterile lines have been developed for this purpose (Virmani and Edwards, 1983). Presently, the hybrid rice varieties in China have shown 20-30 per cent higher yield than the conventionally bred rice varieties and have been found to possess better and wider adaptability (Lin and Yuan, 1980). The present investigation attemps to assess the extent of heterosis for yield and its component traits in thirty six hybrids.

MATERIALS AND METHODS

During *kharif* 1993, thirty six hybrids were evaluated at the Agricultural College and Research Institute, Killikulam. The crosses were made utilising three cytoplasmic genetic male sterile (CMS) lines (V 20 A, IR 58025 A and IR 62829 A) and twelve testers (AS 89044, AS 90043, AD 90190, Kasturi, Pusa basmati, IR 50, ADT 39, IR 64, IR 72, TKM 9, ASD 16 and CO 37). The hybrids along with their parents were grown in the field in randomised block design with three replications with a single seedling per hill. A spacing of 20 cm between rows and 15 cm between plants was adopted. Observations were recorded on five randomly selected plants in each replication for six biometric traits. The overall mean value for each parent and hybrid was taken for computation of heterosis over standard parent (diii). The significance was tested by using the formula given by Wynne *et al.* (1970).

RESULTS AND DISCUSSION

The data on heterosis are presented in Table 1. Among the hybrids, V 20 A x ASD 16 was the earliest to flower in 66 days showing -9.5 per cent value. Singh *et al.* (1980) also reported heterosis for earliness in flowering and indicated that earliness was dominant over lateness. Marked heterosis was observed for number of panicles per plant in most of the hybrids studied. A high standard heterosis of 45 per cent for this trait was observed in the hybrid IR 58025 A x AS 90043. High and significant heterotic effect were observed for grains per panicle (31%) in V 20 A x Kasturi hybrid. Heterosis for grains per panicle contributing to increased yield was reported by Sharma and Mani(1990). Significant and positive standard heterosis was observed in the hybrid IR 58025Ax CO 37 for spikelet fertility. Heterosis for spikelet fertility was attributed as one of the reason for increased yield in most heterotic F_1 hybrids (Kim and Rutger, 1988).

In the present study, high significant positive standard heterosis was observed in the hybrid V 20 A x IR 64 for 100 - grain weight. A total of 33 hybrids showed significant negative standard heterosis indicating little scope for improving this trait through exploitation of heterosis. Nijaguna and Mahadevappa (1983) reported positive and negative heterotic effects for this trait. Significant heterosis for grain yield was found in 2 of 36 hybrids in the present study. IR 6 282 9 A x CO 37

Table 1. Standard heterosis (dii) in per cent for yield and its components in rice hybrids

Hybrid	Days to flowering	Panicles per plant	Grains/panicle	Spikelet fertility	100 grain weight	Grain yield per plant
V20A/AS 89044	12.22**	-3.00	-47.50**	-11.50**	-19.50**	-46.34**
V20A/AS 90043	22.62**	31.11**	-24.75**	-15.90**	-26.50**	-54.53**
V20A/AD 90190	16.30**	28.15**	-57.75**	-17.33**	-19.24**	-51.51**
V20A/Kasturi	-5.90**	29.65**	31.03**	-5.52**	-28.70**	-59.91**
V20A/Pusabasmati	16.30**	4.44	-51.85**	-18.30**	-29.60**	-51.94**
V20A/IR 50	-5.90**	20.74**	-54.60**	-4.71**	-8.34**	-44.07**
V20A/ADT 39	24.00**	28.90**	-33.90**	-16.70**	-16.60**	-39.44**
V20A/IR 64	10.00**	34.10**	-25.71**	-1.70	6.50**	-53.90**
V20A/IR 72	23.08**	17.80**	-40.20**	-21.20**	-21.80**	-12.82**
V20A/TKM 9	-1.40*	28.15**	-45.52**	-10.91**	-3.44**	-31.14**
V20A/ASD 16	-9.50**	35.60**	-57.40**	-14.32**	0.11	-48.40**
V20A/CO 37	-3.20**	32.60**	-53.10**	-15.00	0.60	-19.20**
IR 58025A/AS89044	14.50**	16.30**	-52.10**	-13.30**	-19.50**	-49.60**
IR 58025A/AS 90043	22.20**	45.20**	-15.20**	-4.10**	-25.60**	-51.20**
IR 58025A/AD 90190	17.65**	32.60**	-50.30**	-11.54**	-18.40**	-48.20**
IR 58025A/Kasturi	-6.90**	14.10**	-35.10**	-7.80**	-29.92**	-51.00**
IR 58025A/Pusa basmati	17.65**	15.60**	-46.04**	-14.14**	-30.03	-50.32**
IR 58025A/IR 50	1.40*	40.00**	-20.60**	-1.84	-18.50**	-7.00**
IR 58025A/ADT 39	22.20**	31.11**	-41.44**	-10.40**	-22.14**	-50.32**
IR 58025A/IR 64	9.05**	39.30**	-31.50**	-5.93**	-1.70*	-39.00
IR 558025A/IR 72	23.53**	38.52**	-26.30**	-8.31**	-22.60**	-39.44**
IR 58025A/TKM 9	6.80**	16.30**	-45.80**	-14.82**	-8.12**	-57.44**
IR 58025A/ASD 16	3.20**	13.33**	-13.43**	-8.62**	-1.45*	-20.70**
IR 58025A/CO 37	4.10**	25.93**	-6.90**	1.62	-4.12**	4.74**
IR 62829A/AS 89044	13.12**	-9.63**	-40.05**	-9.12**	-19.50**	-57.11**
IR 62829A/AS 90043	22.62**	37.80**	-16.31**	3.41**	-25.92**	-52.05**
IR 62829A/AD 90190	18.10**	2.22	-52.52**	-18.41**	-19.50**	-26.30**
IR 62829A/Kasturi	-5.90**	0.0	-27.43**	-3.23**	-29.40**	-38.90**
IR 62829A/Pusa basmati	17.65**	10.40**	-45.60**	-18.10**	-29.50**	-50.80**
IR 62829A/IR 50	2.71**	20.74**	-51.80**	-16.20**	-18.40**	-34.30**
IR 62829A/ADT 39	20.81**	24.44**	-31.13**	-9.83**	-23.25**	-35.34**
IR 62829A/IR 64	9.50**	12.60**	-28.54**	-4.45**	-18.24**	-18.64**
IR 62829A/IR 72	22.62**	20.00**	-26.91**	-6.74**	-19.60**	-40.52**
IR 62829A/TKM 9	5.90**	17.04**	-34.10**	-8.53**	-2.00**	-33.10**
IR 62829A/ASD 16	-0.90	14.81**	-20.72**	-7.90**	-4.23**	-30.40**
IR 62829A/CO 37	0.90	38.52**	-0.14	-4.00**	-10.80**	19.83**

Standard parent = IR 50

* Significant at 5 per cent level; ** Significant at 1 per cent level

and IR 58025 A x CO 37 recorded significant positive standard heterosis for grain yield.

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OPTIMUM DATES OF SOWING FOR FOXTAIL MILLET UNDER RAINFED CONDITIONS IN LOWER BRAHMAPUTRA VALLEY ZONE OF ASSAM

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ABSTRACT

In order to find out optimum dates of sowing of foxtail millet for Lower Brahmaptura Valley Zone of Assam, a field experiment was conducted during *rabi*, 1989-90 and 1990-91 at the Regional Agricultural Research Station, Gossaigaon with eight dates of sowing (16th, 26th December,5th, 15th, 25th January, 4th, 14th and 24th February) in randomised block design with three replications. The grain and straw yield were highest on 15th January sowing and decreased beyond this date. The optimum sowing time was found to be mid-January.

KEYWORDS: Rainfed, Foxtail Millet, Date of Sowing, Assam

Foxtail millet (*Setaria italica* Beauv) is grown as '*cawn*' during *rabi* under rainfed conditions in the Lower Brahmaputra Valley Zone of Assam. Date of sowing is an important agronomic factor upon which yield depends. It can yield 1.5 to 2.0 t ha^{-1} with improved practices (Chaudhari *et al.*, 1980). Informations regarding optimum dates of sowing for this crop are very meagre in this zone. Hence, the present study was undertaken to find out the optimum dates of sowing of this crop for the Lower Brahmaputra Valley Zone of Assam.

MATERIALS AND METHODS

The field experiment was conducted at the Regional Agricultural Research Station, Gossaigaon, Assam during *rabi*, 1989-90 and 1990-91 in a randomised block design with three replications. Treatments comprised of eight dates of sowing *viz.*, 16th, 26th December, 5th, 15th, 25th January, 4th, 14th and 24th February in both the years. Individual plots (4 m X 3 m) were fertilized @ 20:10:10 kg ha^{-1} of N, P_2O_5 and K_2O before sowing as basal. Seeds of a 'local' yellow seeded variety were sown @ 10 kg ha^{-1} with a spacing of 25 cm between rows. Data on plant height, number of tillers, grain and straw yield were recorded at harvest during 1989-90 but in 1990-91 only grain and straw yield were recorded. Data were statistically analysed as per design adopted.

RESULTS AND DISCUSSION

Results revealed that the differences due dates of sowing on plant height recorded 1989-90 were significant (Table 1). Tallest plan were recorded on 15th January sowing ar thereafter, the values decreased graduall However, plant height of 15th, 25th January, 4 and 14th February were at par. Dates of sowir could not produce any significant effect on numb of tillers m^{-1}. However, the differences on gra yield due to dates of sowing were significant both 1989-90 and 1990-91 (Table 1). Grain yie reached maximum of 15th January sowing in bo the years and thereafter, decreased sharply reachir lowest on 24th February sowing. The mean gra yield decreased rapidly when the sowings we postponed beyond 15th January as evidenced t the meagre yield of 6.5, 4.5, 3.6 and 2.7 q ha^{-1} f 25th January, 4th, 14th and 24th February sowir respectively and this increase ranged from 45 (25 January) to 76 per cent (24th February) from th of 15th January sowing. The reduction of gra yield for late sowing might be due to moistu stress at early growth stage and high temperatu during grain filling stage which might ha affected the formation of grains.

Significant differences on straw yield we observed in 1990-91 only. Straw yield becan highest on 15th January sowing thereafte