Indian J. Genet., **50**(2): 127–130 (1990)

ASSESSMENT OF COMBINING ABILITY, HETEROSIS AND GENETIC VARIANCE FOR FRUIT QUALITY CHARACTERS IN MUSKMELON (*CUCUMIS MELO* L.)

K. S. RANDHAWA AND MONINDER JIT SINGH

Department of Vegetable Crops, Landscaping and Floriculture, Punjab Agricultural University, Ludhiana 141004

(Received: March 9, 1987; accepted: March 15, 1989)

ABSTRACT

Combining ability, heterosis, and genetic variance for yield, maturity, and plant characters in muskmelon (*Cucumis melo* L.) were estimated through the use of six-parent diallel during 1984–85. The sca variance exceeded gca for all the traits. Durgapur Madhu was the best general combiner for fruit yield. Punjab Sunehri had exceptional gca for the traits associated with earliness, and WMR 29 combined well for vine length. Favourable heterosis over midparent was observed for fruit yield, fruit number, fruit weight, fruit bearing branches, node of first female flower, days to harvest, and vine length. The estimates of dominance variance exceeded those of additive variance revealing overdominance for most of the traits.

Key words : Combining ability, heterosis, muskmelon.

Muskmelon is an important vegetable of the tropics and subtropics, and its genetic diversity has been utilised in various breeding programmes [1–4]. Hybrids have been developed for earliness over their parents [1, 3, 5] and some of them are reported to be more vigorous as well [1, 3, 6]. These investigations, however, were restricted to a particular set of breeding lines and did not cover the wide spectrum of variability available with the breeder. Keeping this in view, the present study has been undertaken to see the effects of hybridization among distinct cultivars of muskmelon.

MATERIALS AND METHODS

Six diverse parent lines were taken for a diallel cross, and the F_1 hybrids raised in randomized complete block design with three replications in the plots consisting of 12 plants each, with 1.5 X 0.6 m spacing. Plants were grown under standard irrigation, cultivation, and pest control measures. Mature fruits were harvested every day.

Yield was evaluated in terms of total fruit yield. Number of fruit bearing branches was also recorded along with fruit number and fruit weight, so as to draw inferences about the most suitable number of fruit bearing branches to ensure high fruit yield. Maturity was estimated by the number of node at which the first female flower appeared and number of days from

transplanting to the first female flower appearance and the beginning of the harvest. Vine length was used as an index of plant vigour and health. Data were recorded on 5 random plants, and plant health evaluated toward the end of the harvest season. The diallel was analyzed for fixed effects, with the combining ability estimates calculated by using Griffing's Model I, Method 2 [7]. The inbreeding coefficient was assumed to be equal to 1, even though the breeding lines were not completely inbred. Each line, however, was inbred to a high degree and was uniform in appearance.

RESULTS AND DISCUSSION

Highly significant differences were found for all traits among all the 21 genotypes (15 hybrids and 6 parents). Among the parent lines, significant differences were detected for all the characters except number of fruit bearing branches and the node bearing first female flower. General combining ability (gca) variance was highly significant for all the traits, except days to first female flower appearance, indicating the importance of additive gene effects. Specific combining ability (sca) variance was also significant for all the traits except fruit yield per vine and days to first female flower appearance, and was consistently greater than gca variance, indicating the preponderance of dominance gene effects.

The gca estimates were calculated to evaluate the combining ability of each breeding line in a series of crosses (Table 1). Variety Durgapur Madhu showed excellent combining ability for early fruit harvest as well as total fruit yield and its contributing traits, i.e. fruit number and weight, but combined poorly for number of fruiting branches. This parent line and its hybrids produced many small, oblong fruits. Variety Punjab Sunehri showed exceptional combining ability for number of fruiting branches and for the traits related with earliness, including days to first female flower and fruit harvest. In respect of total yield, however, the crosses of variety Durgapur Madhu were superior than those of PMR 5 and Pusa Madhuras, both of which showed good gca for total fruit yield. Line WMR 29 had the highest combining ability for vine length. This parent line and its hybrids produced early yield of medium sized fruits. Hara Madhu was late and produced large fruits.

Table 1. Gca estimates of six muskmelon lines for yield, maturity, and plant characters used in the diallel cross

Trait	Hara Madhu	Punjab Sunehri	Pusa Madhuras	Durgapur Madhu	PMR 5	WMR 29	C.D. 5%
Fruit yield (kg)	0.03	–0.03	0.06*	0.06*	0.08**	0.14**	0.06
Fruit weight (g)	15.55**	13:17	10.59	–8.85	14.36	–44.82**	15.05
Fruits/plant	0.18**	0.19**	0.08	0.20**	–0.07	0.20**	0.13
Fruiting branches/plant	0.11	0.30**	0.07	0.12	0.07	–0.55	0.20
Node bearing first female flower	0.79**	–0.08	–0.13	–0.71**	0.79**	–0.66**	0.42
Days to first female flower	0.14	–1.90**	0.30	0.26	1.80**	–0.60	0.63
Days to harvest	1.32**	–1.63**	1.74**	–1.51**	0.90**	–1.01**	0.80
Vine length (cm)	12.57**	–27.35*	7.19*	4.24	11.98**	–18.64**	6.87

*,** Significant at 5% and 1% levels, respectively.

With respect to general plant health, the late maturing lines were often the healthiest (Table 2). Expectedly, vine length was associated with higher number of fruiting branches and higher total yield. On per unit area basis, however, less vigorous but productive types like Durgapur Madhu, Punjab Sunehri and WMR 29 may be better suited to maximize yield through increased plant populations.

Table 2. Mean performance of parental lines (P) of muskmelon and the average of their hybrids (H) for yield maturity and plant characters, heterosis values, and the percentage of hybrid crosses which were uperior to the mid parent (MP) and superior parent (SP)

Line	Fruit yield (kg)		Fruit weight (g)		Fruit per plant (g)		Fruiting branches per plant		Node bearing first female flower		Days to first female flower		Days to harvest		Vine length (cm)	
	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H
Hara Madhu	1.01	1.41[x]	463.1	546.2[y]	2.17	2.69[x]	3.33	3.89[x]	5.33	5.06	40.0	37.5	79.7	73.9	211.7	185.1
Punjab Sunheri	0.76	1.16	534.2	537.5	1.42	2.32	3.33	3.33	4.67	4.28	35.7	35.8[x]	69.7	70.9[x]	136.3	157.5[x]
Pusa Madhuras	1.23	1.27	557.6	542.0	2.21	2.46[y]	3.67	3.78[y]	6.67	4.11	30.3	37.9	90.7	75.0	229.7	188.7
Durgapur Madhu	1.03	1.37[y]	443.6	511.4	2.33	2.69[x]	3.33	3.89[x]	6.00	3.45[y]	38.3	38.0	74.7	72.0	215.7	184.8
PMR 5	1.23	1.29	614.9	556.0[x]	2.01	2.41	3.67	3.78[y]	5.67	4.89	36.3	39.1	70.3	73.0	144.0	179.8
WMR 29	1.06	1.20	463.9	481.0	1.29	2.33	3.67	3.61	2.00	3.34[x]	34.0	36.8[y]	68.0	71.4[y]	123.3	158.0[y]
Mean	1.05	1.28	512.9	529.0	1.91	2.48	3.50	3.76	5.06	4.19	37.4	37.5	75.5	72.7	185.1	175.7
Heterosis[x] MP		140.5	89.9	90.9	52.3	-57.1	-12.5	-12.6	-26.7							
SP		89.7	76.0	64.3	9.3	-50.0	-9.7	-11.7	-8.3							
Heterotic crosses % MP		93.3	93.3	100.0	66.7	53.3	60.0	80.0	46.7							
SP		60.0	93.3	93.3	26.7	33.3	33.3	66.7	26.7							

z—The best line in average hybrid performance, y—the second best line in average hybrid performance and x—favourable heterosis.

High positive midparent (MP) in desirable direction was observed for all the traits except vine length (Table 2). Heterosis over better parent (BP) was observed for days to first fruit harvest and all yield characters, except fruiting branches/plant. These values of heterosis indicate that the hybrids, in general, set more fruits than their parents. The higher heterosis for total yield as opposed to individual fruit weight indicates increased fruit number in the hybrids.

Finally, we found that heterosis among different hybrids was almost of the same magnitude irrespective of diverse origin of the parental lines (Tables 2 and 3). This may be attributed to some similarity in the genetic constitution of the lines. Lack of compatibility among different lines also cannot be ruled out as intraregional crosses were superior than the interregional ones for yield and its components (Table 3). Heterosis for other characters, did not necessarily follow a similar pattern of intraregional superiority.

Table 3. Mean performance of muskmelon lines from different regions and their hybrids for yield, maturity, and plant characters

Trait	Parent lines		Intraregional hybrids	Intraregional hybrids	
	indigenous	exotic	(indigenous x exotic)	indigenous	exotic
Fruit yield (kg)	1.0	1.2	1.2	1.3	1.5
Fruit weight (g)	494.2	515.8	503.7	502.2	525.0
Fruits/plant	2.0	1.7	2.4	2.7	2.9
Days to harvest	78.7	69.2	74.1	67.3	69.6
Vine length (cm)	198.4	163.7	163.0	165.3	145.3

Since both additive as well as nonadditive gene effects were present for many traits, reciprocal recurrent selection procedure can be followed. Diallel selective mating, as suggested by Jensen [8] can also be taken up to utilize the best combining parents to develop still better recombinants.

REFERENCES

1. M. L. Chadha and K. S. Nandpuri. 1980. Hybrid vigour studies in muskmelon. Indian J. Hort., **37**: 276–282.

2. R. E. Foster. 1967. F_1 hybrid Muskmelon-1. Superior performance of selected hybrids. Proc. Amer. Soc. Hort. Sci., **91**: 390–395.

3. L. F. Lippert and P. D. Legg. 1972. Dialle analysis for yield and maturity characters in muskmelon cultivars. J. Amer. Soc. Hort. Sci., **97**: 87–90.

4. H. M. Munger. 1942. The possible utilization of first generation muskmelon hybrids and improved method of hybridization. Proc. Amer. Soc. Hort. Sci., **40**: 405–410.

5. C. W. Boh and C. N. Davis. 1957. Earliness in F_1 hybrid muskmelon and their parent varieties. Hilgardia, **16**: 462–471.

6. B. Kubichi. 1962. Inheritance of some characters in muskmelon (*Cucumis melo* L.), Genet. Polon., **3**: 265–274.

7. B. Griffing. 1956. Concept of general and specific combining ability in relation to diallel crossing systems. Aus. J. Biol. Sci., **9**: 463–493.

8. N. F. Jensen. 1970. A diallel selective mating system for cereal breeding. Crop Sci., **10**: 629–635.