Annals of Arid Zone 29 (2) : 117-119, 1990

COMBINING ABILITY AND GENE EFFECTS FOR HARVEST INDEX IN DURUM WHEAT

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ABSTRACT

Parents with good general combiner were A 9-30-1 for biomass and grain yield, Raj-1555 for biomass and harvest index and DWL 5023 for grain yield and harvest index. Hybrids DWL 5023 x Meghdoot was good combination for biomass, grain yield and harvest index. Dominance component of variation was important for all traits under study. The traits barring harvest index were inherited by more number of dominant alleles than recessive with symmetrical in distribution. The tall growing A 9-30-1 was observed with maximum dominant genes while dwarf DWL 5023 had maximum recessive genes for these traits.

INTRODUCTION

Durum wheat apart from its export potential also owns suitability for water stress areas. High yield in recent varieties of wheat have been attributed mainly to increased harvest index rather than increased total biological yield (Watson et al. 1963). In selection programme harvest index helps as an index of selection for yield improvement. It is therefore, important to collect information on combining ability, gene action and inheritance of harvest index and its two main components, to decide a reasonable breeding strategy.

MATERIAL AND METHODS

Seven durum wheat (*T. durum* Desf.) cultivars belonging to two different height groups (Dwarf : DWL-5023, Raj-911, Raj-1555, Jori-69; tall: A 9-30-1, Bijaga yellow, Meghdoot) of durum wheat were used to make 7x7 diallel (one way). Resulted 21 hybrids alongwith their 7 parents were grown in a Randomised Block Design with three replications during rabi 1983-84. Mean observations were recorded on five competetive plants for each treatment in respect of biological yield/plant (g), grain yield/plant (g) and harvest index (%). Analysis of combining abilities and gene effects was carried following Griffing (1956) Model-1 Method-2 and Hayman (1954) respectively.

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RESULTS AND DISCUSSION

Significant mean squares for general combining ability (gca) and specific combining ability (sca) were observed for all traits barring sca for biological yield (Table 1) indicateing the importance of both additive and non-additive gene effects for grain yield and harvest index. The gca : sca ratio showed pre-dominance of additive gene effects for grain yield and biological yield. The parent A 9-30-1 had high gca effects for biological yield and grain yield. Whereas, DWL 5023, Raj-1555 and Raj-911 were categorised with gca for harvest index (Table 1).

Table 1. Mean variance and combining ability variance in durum wheat (*T. durum*)

Source	df	Mean squares		
		Biomass/plant (g)	Grain yield/plant (g)	Harvest index (%)
Replication	2	656.84	78.42	0.50
Genotype	27	812.41	153.96**	119.92**
Error	54	461.36	60.25	2.01
gca	6	683.60**	85.89**	37.00**
Sca	21	153.95	42.65**	91.63**
Error	54	153.78	20.08	0.67
gca:sca		4.4:1	2.01:1	0.40:1
r (gca, per se)		0.50	0.53	0.07
r (sca, per se)		0.96**	0 95**	0.98**
Best general		A 9-30-1 (8.9*)	A 9-30-1 (5.7**)	DWL-5023 (3.4**)
Combiners		Raj-1555 (-7.8*)	DWL-5023 (-3.3*)	Raj-1555 (2.82**)
Best specific		1 x 7 (42.0**)	1 x 7 (18.9**)	6 x 7 (14.4**)
Combinations			6 x 7 (9.1**)	5 x 7 (11.3**)
			5 x 3 (6.9*)	5 x 2 (8.3**)

* $P \leqslant 0.05$, ** $P \leqslant 0.01$

1 DWL-5023, 2 Raj-911, 3 Raj-1555, 4 Jori-69, 5 A-9-30-1, 6 Bijaga yellow, 7 Meghdoot

The cross DWL-5023 x Meghdoot showed high sca effects for all the three traits while Bijaga-yellow x Meghdoot had higher sca estimates for grain yield. However, little gain is expected in former cross in subsequent generations as both the parents involved were poor general combiners but may throw some segregants for harvest index for which parent DWL-5023 was good general combiner. This cross may be superior due to dominance and epistasis gene effects which is difficult to exploit through simple breeding procedures. However, for harvest index cross A 9-30-1 x Raj-911 and DWL-5023 x Meghdoot may be expected to produce transgressive segregants in subsequent generations since one of the parents included was good general combiner (Table 1). Significant rank correlation between sca effects and *per-se* performance of hybrids for all the three traits indicated that *per-se* performance may be a good critarion for selecting better crosses (Table 1).

Harvest index failed to fulfill the assumptions of diallel which indicate its complex nature of inheritance. On the other hand all genetic components viz. D, H_1, H_2, H^2 and F were found non-significant for biological yield and grain yield which otherwise fulfill the assumptions of diallel. Hence, the ratios of genetic component may not have any implication (Table 2). Sufficient amount of genetic diversity among parents, for

Table 2. Estimates of genetic components in durum wheat (*T durum*).

Components	Biomass/plant (g)	Grain yield/plant (g)	Harvest index (%)
b	0.40	0.37	0.34**
t^2	0.34	0.00	-61.95*
D	182.12	37.09	40.89
H_1	744.25	154.44	282.84
H_2	550.74	110.14	339.06
H^2	247.67	78.93	0.32
F	526.19	50.76	-37.02
E	153.78*	20.08	0.67
h^2 (n.s)	14.16	16.77	11.25

* $P \leqslant 0.05$; ** $P \leqslant 0.01$

both component traits, was indicated in graphical array distributions along regression line. Parents A 9-30-1, Jori 69 were having maximum dominant genes while DWL-5023 was having maximum recessive genes for grain yield. Maximum dominant and recessive genes for biological yield were located in parents A 9-30-1 and DWL-5023 respectively. The result discussed above showed harvest index with its low gca and complex erratic inheritance; as it fail to fulfill the assumptions of diallel, do not provide much opportunity of selection over and above its two main component, i. e. grain yield and biological yield in durum wheat.

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