Project review and planning meeting at Udaipur, Rajasthan, India.

SPAD chlorophyll meter used in the WUE studies.

Evaluation of Trait-based and Empirical Selections for Drought Resistance at Udaipur, Rajasthan, India

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Introduction

PEANUT IN RAJASTHAN is mainly grown as a rain-fed crop on 0.27 M ha, with an in-shell production of 0.26 M tonnes. The productivity of peanut in Rajasthan is 964 kg/ha (Rajasthan State Agricultural Marketing Board, 2000), which is slightly higher than the national average of 833 kg/ha (Dept. of Agric. & Coop., 2000) Drought is the most important constraint affecting productivity of rain-fed agriculture in Rajasthan. Therefore varieties efficient in water-use can raise productivity of rain-fed agriculture throughout the State.

Udaipur in Rajasthan was chosen as one of the locations for the multi-environment evaluation of trait-based and empirical selections developed under the ACIAR-ICAR-ICRISAT collaborative project 'More efficient breeding of drought resistant peanuts in India and Australia'.

Materials and Methods

Udaipur is situated at 579.5 m above sea level, at latitude 24.35ºN and longitude 74.30ºE. The climate of this region is sub-humid, with an average annual rainfall of 637 mm. Most of the rainfall is received during the monsoon season, which extends from July to October.

The experimental materials consisted of eight parents (ICGS 76, CSMG 84-1, ICGS 44, ICGV 86031, TAG 24, GG 2, JL 220, and K 134) and 192 progenies, which were selected as described elsewhere in these Proceedings.

The experiment was laid out in an incomplete block design (alpha design) with three replications. Each replication had 50 blocks, 48 for selections and two for parents, each with four plots. Each plot consisted of four four-metre rows. The inter-row and intra-row spacing were 30 and 10 cm, respectively. The basal dose of fertilisers consisted of 44 kg urea (20kg N) and 375 kg single super phosphate (60 kg P_2O_4) per hectare. Before sowing, the seeds were treated with 1% ethrel solution to break any seed dormancy. For protection from fungi and insects, seeds were treated with Bavistin (3 g/kg of seed) and chlorpyriphos 20 EC (1.5 litres/100 kg of seed). At 35–40

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days after sowing, chlorpyriphos 20 E.C. was again applied to the soil to control termites. Other agronomic practices were followed as per local recommendations.

Following the procedures described elsewhere in these proceedings, the observations recorded on each treatment included SPAD chlorophyll meter reading, plant number, vegetative weight, pod weight and kernel weight.

Results and Discussion

After good rains in the initial stages, the crop faced intermittent dry spells during the season and suffered severe end-of-season drought. The maximum temperature was around 30° C and the minimum around 25° C until 38 DAS. After that, the maximum temperature gradually increased and the minimum decreased as the season progressed. The radiation also showed an increase from 37 DAS and reached 20MJ/m^2 around 43 DAS.

Data corresponding to the 200 genotypes (192 progenies + 8 parents) for kernel yield (kg/ha), kernel HI, TE and T were subjected to a simple-analysis, assuming genotypic effects to be random. Genotypes showed significant differences in all the four traits mentioned above.

The top 20 genotypes for kernel yield consisted of nine trait-based and 11 empirical selections (Table 1). Among the top 20 genotypes, the kernel yield was 3411–4662 kg/ha, HI 0.39–0.47, TE 2.01–2.16 g/kg and T 377–492 mm. Five genotypes (JAL 17, JUG 11, ICR 39, ICR 23 and JAL 24, four from trait and one from empirical selection method) showed a significant improvement (from 12.7 to 28.1%) for kernel yield over the highest-yielding parent at this location (TAG 24, 3639 kg/ha). For these five genotypes, an increase over TAG 24 in HI (0.4%–3.2%) for four, in TE (1.2%) for three and in T (10.5%–27.6%) for all five genotypes was found. JAL 17, ICR 39, and ICR 23 had an increase in all the three traits over the control. TIR 17 and ICR 05, in spite of their having the highest increase in TE over the control, could not score in kernel yield because of their lower values for HI and T. An optimal combination of HI, TE and T is required to achieve higher yields.

Ignoring statistical significance, 10 genotypes of the 20 for kernel yield, 5 for HI, 11 for TE and 16 for T had a positive increase over the best-yielding parent TAG 24. For three genotypes, HI, TE and T showed a positive improvement. For six genotypes, a combination of HI and T (in two cases) or TE and T (in four cases) were positive. The HI and T combination was able to bring about a positive increase in kernel yield, but not the TE and T combination (except in one case). The remaining 11 genotypes had a positive increase in either T (in seven cases) or TE (in four cases) alone over TAG 24, of which four genotypes with positive increase in T showed a positive increase in kernel yield.

Table 1. Top 20 genotypes for kernel yield, HI, Transpiration efficiency (TE) and Transpiration (T) in the 2000 rainy season, Udaipur.

Geno-ID	Selection	Yield (kg/ha)	HI	TE (g/kg)	T (mm)
JAL 17	IRR	4662	0.47	2.10	460
JUG 11	DRO	4456	0.46	2.01	492
ICR 39	EMP	4196	0.46	2.10	426
ICR 23	IRR	4171	0.46	2.10	430
JAL 24	IRR	4103	0.45	2.06	443
JAL 43	EMP	3940	0.44	2.02	455
JAL 32	EMP	3924	0.46	2.07	411
JAL 21	IRR	3794	0.43	2.11	414
JAL 46	EMP	3746	0.42	2.01	459
JUG 40	EMP	3686	0.41	2.07	434
TIR 17	IRR	3517	0.43	2.16	377
JAL 12	DRO	3516	0.40	2.05	433
TIR 38	EMP	3504	0.42	2.04	419
JUG 35	EMP	3501	0.39	2.10	423
JAL 29	EMP	3460	0.42	2.14	380
TIR 40	EMP	3425	0.42	2.10	381
ICR 16	IRR	3414	0.40	2.10	401
ICR 05	DRO	3411	0.40	2.16	386
JAL 37	EMP	3411	0.41	2.14	384
ICR 44	EMP	3402	0.42	2.05	403
ICGS 44	P	2856	0.37	2.10	375
ICGS 76	P	2350	0.32	2.17	334
CSMG 84-1	P	3221	0.40	2.08	400
ICGV 86031	P	3075	0.38	2.17	371
TAG 24	P	3639	0.46	2.07	386
JL 220	P	3231	0.42	2.02	401
GG 2	P	3336	0.41	2.04	416
K 134	P	2345	0.36	2.03	340
Grand mean		2786	0.37	2.11	355
LSD		400.8	0.031	0.108	38.7

Conclusions

At the Udaipur location, the progenies with the best kernel yield were from the trait-based selection approach. The superiority in kernel yield was accompanied with superiority in HI, TE, and T, either alone or in combination. For achieving maximum yield, an optimum combination of these traits is required.

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