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Correlation Studies of Spanish Bunch Groundnut Under Drought Stress and Non Stress Situations

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Simple correlation between oil yield and its component characters was studied to identify the selection indices in three crosses using $F_{2:3}$ population of ICGV 91114 x ICGV 01279, K 1375 x ICGV 98170 and ICGV 02125 x ICGV 98175 under drought stress and non stress conditions. Oil yield per plant and kernel yield per plant expressed significant and positive correlation with number of pods per plant, 100- pods weight, 100- kernels weight, shell weight, shelling percentage and pod yield per plant under both drought stress and non stress conditions in all three crosses. Hence, these traits might be considered as selection indices irrespective of stress situation, and they might be considered as important yield attributing characters and due emphasis should be placed while breeding for high kernel yield in groundnut.

Key words: Groundnut, crosses, $F_{2:3}$ generation, Correlation, Non stress, Drought stress

Groundnut is an important oilseed crop in India. It is a major crop in most tropical and subtropical regions of the world. Peanut seeds are of high value because of their contents of oil (43-54%) and protein (25-30%). Peanut yield in rainfed areas has been limited by drought stress because pod yield and other growth parameters are severely affected (Pimratch *et al*., 2008 and Songsri *et al*., 2008). Yield losses had been estimated to be 56-85% (Rao *et al.,* 1989) depending on crop growth stages when the crop was exposed to drought (Reddy *et al*., 2003), drought intensity and drought duration (Nigam *et al.,* 2005). The use of drought resistant varieties is an important strategy to combat the drought problem. The efficiency of selection mainly depends on the direction and magnitude of association between yield and its components. Knowledge on the strength and type of association is an important pre-requisite for the formulation of breeding procedure. Hence, correlation studies provide an opportunity to study the magnitude and direction of association of yield with its components and also among various components. Correlations among the yield components enhance the precision of selection. With this view, the present study was conducted to evaluate $F_{2:3}$ generation of three groundnut crosses to determine the association between yield and yield component traits.

Materials and Methods

The experimental material comprised of three crosses *viz.,* ICGV 91114 x ICGV 01279, K 1375 x ICGV 98170 and ICGV 02125 x ICGV 98175. The $F_{2:3}$ population of three crosses were screened under drought stress and non drought stress conditions to investigate the relationship among yield and yield component traits. The crop was raised during *rabi*, 2013 (January-April, 2013) at the Oilseed farm, Tamil Nadu Agricultural University, Coimbatore. Row to row and plant to plant spacing were maintained at 30 cm and 10 cm, respectively. The drought stress was imposed by withholding irrigation after 60 days of sowing for the drought stress trial. Observations were recorded on single plant basis from each entry for 11 characters *viz.*, number of pods per plant, 100- pods weight (g), 100- kernels weight (g), shell weight of 100- pods (g), shelling percentage (%), SPAD Chlorophyll Meter Reading (SCMR), Specific Leaf Area (SLA) (cm_2/g), pod yield per plant (g), kernel yield per plant (g), oil content
(%) and oil yield per plant (g). The data were statistically analyzed and correlation coefficient analysis for yield and yield components was carried out by utilizing the formula suggested by Al-jibouri *et al.* (1958).

Results and Discussion

In the present investigation, simple correlation between oil yield and its component characters was studied to identify the selection indices in three crosses using $F_{2:3}$ population of ICGV 91114 x ICGV 01279, K 1375 x ICGV 98170 and ICGV 02125 x ICGV 98175 under drought stress and non stress conditions. The results of the correlation coefficient are shown in the Table 1, 2 and 3. Analysis of variance revealed highly significant differences among the genotypes for all the traits in both conditions thereby showing sufficient variability present in the material studied.

Among the 11 characters studied seven

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Table 1. Simple correlation coefficients between yield and yield component traits under drought stress and non stress in the generations of cross ICGV 91114 x ICGV 01279

Character	Stress	Number of pods/ plant	100 pods weight (g)	100 kernels weight (g)	Shell weight (g)	Shelling percentage	SPAD Chlorophyll Meter Reading (SCMR)	Specific Leaf Area (SLA) (cm^2/g)	Pod yield / plant (g)	Kernel yield/ plant (g)	Oil content (%)
Number of pods/ plant	DS	1.00									
	NS	1.00									
100- pods weight (g)	DS	0.64 **	1.00								
	NS	0.51 **	1.00								
100- kernels weight (g)	DS	0.14	0.64 **	1.00							
	NS	-0.10	0.50 **	1.00							
Shell weight (g)	DS	0.49 **	0.94 **	0.57 **	1.00						
	NS	0.30	0.73 **	0.27	1.00						
Shelling percentage	DS	0.29 *	0.13	0.28 *	-0.16	1.00					
	NS	0.32	0.46 *	0.42 *	-0.22	1.00					
SCMR	DS	-0.09	0.20	0.10	0.27	-0.04	1.00				
	NS	0.04	-0.04	-0.04	-0.11	0.05	1.00				
SLA (cm^2/g)	DS	0.06	0.01	-0.02	0.03	-0.12	-0.19	1.00			
	NS	-0.17	-0.04	0.04	-0.12	0.14	-0.14	1.00			
Pod yield /plant (g)	DS	0.90 **	0.85 **	0.46 **	0.73 **	0.21	-0.02	0.07	1.00		
	NS	0.89 **	0.73 **	0.08	0.55 **	0.27	-0.05	-0.15	1.00		
Kernel yield/ plant (g)	DS	0.90 **	0.78 **	0.46 **	0.58 **	0.42 **	-0.06	0.04	0.97 **	1.00	
	NS	0.88 **	0.77 **	0.21	0.38 *	0.57 **	0.00	-0.09	0.94 **	1.00	
Oil content (%)	DS	-0.20	0.02	0.22	0.02	-0.04	-0.13	-0.17	-0.11	-0.11	1.00
	NS	-0.07	-0.21	-0.31	-0.25	0.07	0.02	0.06	-0.20	-0.16	1.00
Oil yield/ plant (g)	DS	0.87 **	0.80 **	0.51 **	0.60 **	0.43 **	-0.07	0.02	0.95 **	0.99 **	0.03
	NS	0.77 **	0.64 **	0.07	0.25	0.56 **	0.02	-0.06	0.77 **	0.85 **	0.36 *

* ,** Significant at 5 % and 1 % level, respectively DS – Drought stress and NS – Non stress

characters *viz.,* number of pods per plant, 100- pods weight, 100 - kernels weight, shell weight, shelling percentage, pod yield per plant and kernel yield per plant had positive and significant correlations with oil yield per plant under drought stress and non stress conditions in all three crosses. In the cross, ICGV 91114 x ICGV 01279, oil content had positive and significant correlation with oil yield per plant under non stress condition. In the cross, K 1375 x ICGV 98170, oil content had positive and significant correlation with oil yield per plant under both the stress and non stress conditions.

Oil yield per plant and kernel yield per plant expressed significant and positive correlation with

Table 2. Simple correlation coefficients between yield and yield component traits under drought stress and non stress in the generations of cross K 1375 x ICGV 98170

Character	Stress	Number of pods/ plant	100 pods weight (g)	100 kernels weight (g)	Shell weight (g)	Shelling percentage	SPAD Chlorophyll Meter Reading (SCMR)	Specific Leaf Area (SLA) (cm^2/g)	Pod yield / plant (g)	Kernel yield/ plant (g)	Oil content (%)
Number of pods/ plant	DS	1.00									
	NS	1.00									
100- pods weight (g)	DS	0.81 **	1.00								
	NS	0.67 **	1.00								
100- kernels weight (g)	DS	0.20	0.59 **	1.00							
	NS	0.17	0.71 **	1.00							
Shell weight (g)	DS	0.78 **	0.94 **	0.40 **	1.00						
	NS	0.64 **	0.75 **	0.23	1.00						
Shelling percentage	DS	0.35 **	0.52 **	0.63 **	0.26	1.00					
	NS	0.35 **	0.71 **	0.85 **	0.13	1.00					
SCMR	DS	-0.41 **	-0.25	0.09	-0.28 **	-0.06	1.00				
	NS	0.09	0.13	0.20	-0.03	0.26	1.00				
SLA (cm^2/g)	DS	0.03	0.06	0.05	0.07	0.08	-0.37 *	1.00			
	NS	0.26	0.26	0.12	0.26	0.19	0.00	1.00			
Pod yield /plant (g)	DS	0.96 **	0.90 **	0.40 **	0.84 **	0.46 **	-0.35 **	0.07	1.00		
	NS	0.89 **	0.87 **	0.48 **	0.68 **	0.58 **	0.13	0.24	1.00		
Kernel yield/plant (g)	DS	0.91 **	0.89 **	0.51 **	0.76 **	0.61 **	-0.29 *	0.05	0.97 **	1.00	
	NS	0.81 **	0.90 **	0.63 **	0.58 **	0.74 **	0.19	0.24	0.97 **	1.00	
Oil content (%)	DS	0.16	0.23	0.37 **	0.08	0.33 *	-0.11	-0.03	0.22 *	0.29 *	1.00
	NS	0.12	0.25	0.30	-0.03	0.46 **	0.14	0.23	0.17	0.26	1.00
Oil yield/ plant (g)	DS	0.88 **	0.88 **	0.54 **	0.72 **	0.63 **	-0.29 *	0.05	0.95 **	0.99 **	0.40 **
	NS	0.78 **	0.89 **	0.64 **	0.54 **	0.78 **	0.21	0.26	0.94 **	0.98 **	0.42 **

* ,** Significant at 5 % and 1 % level, respectively DS – Drought stress and NS – Non stress

number of pods per plant, 100- pods weight, 100-kernels weight, shell weight, shelling percentage and pod yield per under both drought stress and non stress conditions in all three crosses. Hence, these traits might be considered as selection indices irrespective of stress situation. These results are confirmative with Sharma and Dashora (2009), John *et al*. (2009) and Zaman *et al.* (2011).

Pod yield per plant had significant and positive association with number of pods per plant, 100-pods weight, 100- kernels weight, shell weight and shelling percentage in all the crosses under both the stress situations. Similar results were also observed by John *et al.* (2009) and Ladole *et al*. (2009).

Number of pods per plant showed positive and significant association with 100- pods weight, shell weight, pod yield per plant, kernel yield per plant and oil yield per plant under both non stress and drought stress conditions in all the crosses. These findings are confirmed with John *et al.* (2007), Ladole *et al.* (2009), John *et al.* (2009), Shoba (2010) and Priyadharshini (2012).

Hundred pods weight expressed positive and significant association with kernel yield per plant, pod yield per plant, 100 - kernels weight and shell weight in all the crosses under both non stress and drought stress conditions. This result was confirmed with Manoharan *et al*. (1990) and Vasanthi *et al*. (1998). It had significant and positive association

Table 3. Simple correlation coefficients between yield and yield component traits under drought stress and non stress in the generations of cross ICGV 02125 x ICGV 98175

Character	Stress	Number of pods/ plant	100 pods weight (g)	100 kernels weight (g)	Shell weight (g)	Shelling percentage	SPAD Chlorophyll Meter Reading (SCMR)	Specific Leaf Area (SLA) (cm^2/g)	Pod yield / plant (g)	Kernel yield/ plant (g)	Oil content (%)
Number of pods/ plant	DS	1.00									
	NS	1.00									
100- pods weight (g)	DS	0.59 **	1.00								
	NS	0.53 **	1.00								
100- kernels weight (g)	DS	0.14	0.73 **	1.00							
	NS	0.32	0.87 **	1.00							
Shell weight (g)	DS	0.56 **	0.93 **	0.58 **	1.00						
	NS	0.48 **	0.91 **	0.66 **	1.00						
Shelling percentage	DS	0.39 *	0.47 **	0.47 **	0.16	1.00					
	NS	0.34	0.53 **	0.64 **	0.16	1.00					
SCMR	DS	0.10	-0.30	-0.40 **	-0.29	-0.12	1.00				
	NS	0.00	-0.37	-0.15	-0.40	-0.19	1.00				
SLA (cm^2/g)	DS	-0.05	0.00	-0.17	-0.01	0.20	-0.06	1.00			
	NS	-0.20	-0.23	-0.30	-0.13	-0.35	0.04	1.00			
Pod yield /plant (g)	DS	0.88 **	0.85 **	0.49 **	0.81 **	0.40 *	-0.11	-0.01	1.00		
	NS	0.92 **	0.78 **	0.62 **	0.70 **	0.46 *	-0.09	-0.21	1.00		
Kernel yield/plant (g)	DS	0.87 **	0.86 **	0.54 **	0.76 **	0.53 **	-0.11	0.02	0.99 **	1.00	
	NS	0.90 **	0.79 **	0.66 **	0.67 **	0.54 **	-0.09	-0.23	0.99 **	1.00	
Oil content (%)	DS	-0.28	0.05	0.15	0.01	0.04	-0.04	0.17	-0.09	-0.07	1.00
	NS	-0.18	0.01	0.16	0.03	-0.13	0.23	0.00	-0.06	-0.07	1.00
Oil yield/ plant (g)	DS	0.76 **	0.86 **	0.60 **	0.76 **	0.54 **	-0.15	0.08	0.95 **	0.97 **	0.17
	NS	0.81 **	0.79 **	0.71 **	0.67 **	0.50 **	-0.08	-0.24	0.94 **	0.95 **	0.24

* ,** Significant at 5 % and 1 % level, respectively DS – Drought stress and NS – Non stress

with shell thickness under non stress and drought stress condition in crosses *viz.,* K 1375 x ICGV 98170 and ICGV 02125 x ICGV 98175.

Hundred kernels weight exhibited positive and significant association with shell weight, shelling percentage, pod yield per plant and kernel yield per plant in the cross ICGV 91114 x ICGV 01279 under drought stress condition. This trait showed positive and significant association with shell weight, shelling percentage, pod yield per plant and kernel yield per plant in the crosses *viz.*, K 1375 x ICGV 98170 and ICGV 02125 x ICGV 98175. Similar findings were reported by Odedara (2005), Manoharan *et al*. (1990), Sharma and Dashora (2009), Shoba (2010), Pradhan and Patra (2011) and Priyadharshini (2012). Shelling per cent recorded positive and significant association with 100-kernels weight in the cross ICGV 91114 x ICGV 01279 under non stress condition. Similar findings were reported by Shoba (2010) and Priyadharshini (2012).

Shell weight and shelling percentage recorded significant and positive association with pod yield , kernel yield and oil yield per plant under both the stress situations in all the crosses. However , shelling percentage had negative association with SPAD Chlorophyll Meter Reading (SCMR) under drought stress conditions in the crosses *viz.,* K 1375 x ICGV 98170 and ICGV 02125 x ICGV 98175. Similar findings were reported by Kotzamanidis *et al.* (2006) and Narasimhulu *et al.* (2012).

SCMR expressed negative and significant correlation with Specific Leaf Area (SLA), pod yield

per plant and kernel yield per plant in the cross K 1375 x ICGV 98170 under drought stress condition.

It was apparent from the present investigation of correlation that the traits *viz*., number of pods per plant, 100- pods weight, 100- kernels weight, shelling per cent and pod yield per plant are desirable selection indices for kernel yield per plant and oil yield per plant under various stress conditions. Hence, these traits may be considered as the important yield attributing characters and due emphasis should be placed while breeding for high kernel yield in groundnut.

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