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Correlation Analysis Among Oil Yield and Component Traits in Groundnut (*Arachis hypogaea L.*)

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The correlation coefficients among ten yield and yield attributing characters towards oil yield were investigated in F_3 generation for three crosses of groundnut during Jan – Apr. 2013. Oil yield had 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 in all the crosses *viz.,* ICGV 00440 x ICGV 03128, ICGV 07359 x ICGV 05100 and ICGV 05100 x Sunoleic95R. All these traits had positive correlation among themselves. In case of cross ICGV 07359 x ICGV 05100 alone, oil yield had positive and significant correlation with kernel yield per plant and oil content. The trait, number of branches had significant and negative correlation with oil yield in all the crosses. Hence, number of branches per plant, number of pods per plant, 100-kernels weight, shell weight, shelling percentage and pod yield per plant may be considered as selection indices for oil yield per plant.

Key words: Groundnut, Oil yield, Selection indices.

Groundnut, *Arachis hypogaea* L., is an important crop for oil production in tropical and subtropical areas. It provides a rich source of high-quality, edible oil (45–55%) and easily digestible protein (23– 25%). Over 60% of global groundnut production is crushed for extraction of oil for edible and industrial uses, while 40% is consumed in food uses and seed purpose. Groundnut oil is an excellent cooking medium because of its high smoking point. India, China, Myanmar, and Vietnam use groundnut oil for cooking purpose extensively. Increasing of oil yield is one of the most important goal in groundnut breeding programme. Direct selection for oil content is not easy, as it involves lengthy laboratory test (soxhlet method) or it requires costly equipment like Nuclear Magnetic Resonance or Near Infra Red spectrophotometer. The standardization of these equipments also need much elaborated exercise and it highly depends upon the spectrum of variability present in the material subjected for standardization. In plant breeding programme understanding the relationships between oil yield and other traits is of paramount importance for making the best use of these relationships in selection. There are conflicting reports on the nature of association between these traits (Cherry *et al.,* 1977; Layrisee *et al.,* 1980), which are largely based on limited numbers of genotypes. Hence, there is a need to acquire more information on the nature of the associations exists between these traits. In the present study, the inter-relationship between oil yield and its component traits were studied using F_3 population of three crosses involving low and high oil content parents of groundnut.

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Materials and Methods

F_3 population of three crosses involving two high oil genotypes *viz.,* ICGV03128 and ICGV05100, two low oil genotypes *viz.,* ICGV00440 and ICGV07359 and a low oil with high oleic genotype *viz.,* Sunoleic95R (Table 1) were evaluated during Jan – Apr. 2013 at the Oilseeds farm, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. Normal agronomic practices were followed under irrigated condition. The data were recorded for various traits *viz.,* number of branches per plant, number of pods per plant, 100-pods weight (g), 100-kernels weight (g), shell weight (g), shelling %, oil content (%) and oil yield (%). Oil content was estimated using SOCS PLUS Two Place Automatic Solvent Extraction System (Model SCS8 AS) (Make: Pelican Equipments, India) and expressed in per cent and oil yield was obtained by multiplying kernel yield per plant with that of oil content and expressed in grams. Simple correlation coefficients were calculated among traits following standard method.

Results and Discussion

Genetic association plays a significant role to study the interrelationship and relative contribution of different characters towards crop improvement. Simple correlation coefficient between yield and yield components in three crosses of groundnut are presented in Tables 2, 3 and 4.

Oil yield had 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 in the cross

Table 1. Particulars of parents studied

	ICGV 03128	ICGV 00440	ICGV 05100	ICGV 07359	Sunoleic95R
Pedigree	(ICGV 99160 x ICGV 99240)	(ICGV 88386x ASHFORD) X ICGV 95172	(((Robust 33-1 x NC Ac 316)xRobust 33-1 x CS 9) F6)xRobust 33-1 x NC Ac 22146xCyto 213-2)xICGV 99160)	(ICGV 01434 x ICGV 86564)	F435 x Component line of 'Sunrunner'
Habit	Virginia bunch	Virginia bunch	Virginia bunch	Virginia bunch	Spanish bunch
Oil content (%)	52-55	42-45	52-55	42-45	35-38
Special features	Drought tolerant	Foliar diseases resistant line	Confectionery line	Confectionery line	High oleic

ICGV 00440 x ICGV 03128. In the cross ICGV 07359 x ICGV 05100, oil yield had significant and positive correlation with traits *viz.,* number of pods per plant, 100-pods weight, 100-kernels weight, shell weight, shelling percentage, pod yield per plant, kernel yield per plant and oil content. In case of cross ICGV 05100 x Sunoleic95R, oil yield recorded positive and significant correlation with number of pods per plant, 100-kernels weight, shell weight, shelling percentage and pod yield per plant. The trait, number of branches per plant had significant and negative correlation with oil yield in all crosses. Sharma and Dashora (2009) and Mahalakshmi *et al.* (2005) recorded significant and positive correlation of oil yield with kernel yield per plant. Sadeghi and Niyaki (2012b) reported significant and positive correlation of oil yield with 100-kernels weight, 100-pods weight, kernel yield per plant and oil content. Lus *et al.* (2011) and Korat *et al.* (2010) recorded significant and positive correlation of number of pods per plant with oil yield per plant.

Association of number of branches per plant with other yield components

This trait had no significant correlation with any traits. Similar results were reported by Sangha *et al.* (1990).

Association of number of pods per plant with other yield components

In the cross ICGV 00440 x ICGV 03128 pod yield per plant had significant and positive correlation with

Table 2. Simple correlation analysis for F_3 generation (Cross ICGV00440 X ICGV03128)

Characters	Number of pods per plant	100-pods weight (g)	100-kernels weight (g)	Shell weight (g)	Shelling percentage	Pod yield per plant (g)	Kernel yield per plant (g)	Oil content (%)	Oil yield per plant (g)
Number of branches per plant	- 0.14	0.13	0.11	0.11	0.07	-0.22	0.19	0.18	- 0.32*
Number of pods per plant		0.28*	0.37*	0.39*	0.25*	0.61*	0.18	0.18	0.62*
100-pods weight (g)			0.56*	0.68*	0.26*	0.51*	0.89*	0.91*	0.31*
100-kernels weight (g)				0.90*	0.86*	0.40*	0.77*	0.68*	0.37*
Shell weight (g) Shelling					0.55*	0.64*	0.81*	0.81*	0.38*
percentage Pod yield						0.00	0.51*	0.33*	0.26*
per plant(g) Kernel yield							0.35*	0.44*	0.67*
per plant (g) Oil content								0.97*	0.19
(%)								0.17	

*Significant at 5% level

100-pods weight, 100-kernels weight, shell weight, shelling percentage and pod yield per plant. In case of ICGV 07359 x ICGV 05100, this trait had significant and positive correlation with 100-pods weight, 100 - kernels weight, shell weight, shelling percentage, pod yield per plant, kernel yield per plant and oil content. In the cross ICGV 05100 x Sunoleic95R, this trait had significant and positive correlation with 100-kernels weight, shell weight and shelling percentage. John *et al*. (2009) found significant and positive association of shelling percentage with this trait. Priyadharshini (2012) and Ladole *et al*. (2009) reported that significant and positive association of pod yield per plant with number of pods per plant. Khanpara *et al*. (2010) recorded significant and positive association of 100-pods weight and 100-kernels weight with this trait. Vaithiyalingan *et al* . (2010) and Sharma and Dashora (2009) reported that significant and positive association of 100-kernels weight with number of pods per plant.

Association of 100-pods weight with other yield components

In the cross ICGV 00440 x ICGV 03128, 100-pods weight had significant and positive correlation with 100-kernels weight, shell weight, shelling percentage, pod yield per plant, kernel yield per plant and oil content. In case of cross ICGV 07359 x ICGV 05100, this trait had significant and positive correlation with pod yield per plant, kernel yield per plant and oil content. In the cross ICGV 05100 x Sunoleic95R, this trait had significant and positive correlation with 100-kernels weight, shell weight,

Table 3. Simple correlation analysis for F_3 generation (Cross ICGV07359 X ICGV05100)

Characters	Number of pods per plant	100-pods weight (g)	100-kernels weight (g)	Shell weight (g)	Shelling percentage	Pod yield per plant (g)	Kernel yield per plant (g)	Oil content (%)	Oil yield per plant (g)
Number of branches per plant	-0.57*	-0.41	-0.33	-0.35	-0.26	-0.48*	-0.31	-0.30	-0.68*
Number of pods per plant		0.50*	0.77*	0.77*	0.66*	0.84*	0.62*	0.60*	0.86*
100-pods weight (g)			0.28	0.34	0.16	0.66*	0.85*	0.89*	0.60*
100-kernels weight (g)				0.96*	0.91*	0.69*	0.63*	0.54*	0.74*
Shell weight (g) Shelling					0.75*	0.82*	0.63*	0.62*	0.77*
percentage Pod yield						0.42	0.54*	0.35	0.60*
per plant(g) Kernel yield							0.72*	0.80*	0.85*
per plant (g) Oil content								0.96	0.68*
(%) *Significant at 5%									0.67*
level									

pod yield per plant, kernel yield per plant and oil content. Kotzaminidis *et al*. (2006) observed that 100-kernels weight was significantly and positively associated with 100-pods weight. Vasanthi *et al.* (1998) recorded significant and positive association of shelling percentage with 100-pods weight.

Association of 100-kernels weight with other yield components

The trait hundred kernels weight recorded significant and positive correlation with shell weight, shelling percentage, pod yield per plant, kernel yield per plant and oil content in all the three crosses *viz.,* ICGV 00440 x ICGV 03128, ICGV 07359 x ICGV 05100 and ICGV 05100 x Sunoleic95R. Mohinder Singh *et al.* (2000) and Venkataramana *et al*. (2000) observed that 100- kernels weight was significantly and positively associated with shelling percentage. Significant positive association of this trait with pod yield per plant was recorded by John *et al.* (2009), Pradhan and Patra (2011), Zaman *et al*. (2011) and Priyadharshini (2012). Sadeghi and Niyaki (2012b),

Table 4. Simple correlation analysis for F_3 generation (Cross ICGV05100 X Sunoleic95R)

Characters	Number of pods per plant	100-pod weight (g)	100-kernels weight (g)	Shell weight (g)	Shelling percentage	Pod yield per plant (g)	Kernel yield per plant (g)	Oil content (%)	Oil yield per plant (g)
Number of branches per plant	-0.23	0.11	-0.25	-0.13	-0.36*	-0.16	0.09	0.12	-0.43*
Number of pods per plant		-0.28	0.46*	0.32*	0.54*	0.32*	-0.08	-0.12	0.56*
100-pods weight (g)			0.38*	0.52*	-0.28	0.59*	0.93*	0.94*	0.01
100-kernels weight (g)				0.92*	0.52*	0.71*	0.59*	0.54*	0.47*
Shell weight (g) Shelling					0.15	0.82*	0.70*	0.70*	0.33*
percentage Pod yield						-0.04	-0.12	-0.23	0.47*
per plant(g) Kernel yield							0.64*	0.66*	0.49*
per plant (g) Oil content								0.99*	0.02
(%) *Significant at 5%									0.00
level									

Jogloy *et al.* (2010) and Kotzamanidis *et al.* (2006) observed that 100-kernels weight was significantly and positively associated with oil content.

Association of shell weight and shelling percentage with other yield components

Shell weight had significant and positive correlation with shelling percentage, pod yield per plant, kernel yield per plant and oil content in the cross ICGV 00440 x ICGV 03128. In the cross ICGV 07359 x ICGV 05100, this trait had significant and positive correlation with shelling percentage, pod yield per plant, kernel yield per plant and oil content. In the cross ICGV 05100 x Sunoleic95R, this trait had significant and positive correlation with pod yield per plant, kernel yield per plant and oil content. Shelling percentage had significant and positive correlation with kernel yield per plant and oil content in the cross ICGV 00440 x ICGV 03128. In the cross ICGV 07359 x ICGV 05100, this trait had significant and positive correlation with kernel yield per plant. Narasimhulu *et al.* (2012), Ladole *et al*. (2009) and Kotzamanidis *et al.* (2006) noticed that significant association of pod yield for this trait. Dhaliwal *et al.* (2010), John *et al.* (2008) Nagda *et al.* (2001) and Venkataramana *et al*. (2000) observed that kernel yield per plant was significantly and positively associated with shelling percentage.

Association of pod yield per plant with other yield components

The trait pod yield per plant recorded significant and positive correlation with kernel yield per plant and oil content in all the three crosses *viz.,* ICGV 00440 x ICGV 03128, ICGV 07359 x ICGV 05100 and ICGV 05100 x Sunoleic95R. Kumar *et al.* (2012), Narasimhulu *et al.* (2012), Priyadharshini (2012), Sharma and Dashora (2009) and John *et al*. (2008) observed that significant and positive association of pod yield with kernel yield per plant. Mahalakshmi *et al.* (2005) observed that pod yield per plant was significantly and positively associated with oil content.

Association of kernel yield per plant with other yield components

In all the three crosses, this trait had significant

and positive relationship with oil content. The cross ICGV 07359 x ICGV 05100 had significant and positive correlation with oil yield per plant. Sadeghi and Niyaki (2012a) found significant and positive relationship between kernel yield with oil yield per plant.

It is therefore, logical to conclude that for improving the oil yield per plant in groundnut, selection has to be exercised on number of branches per plant, number of pods per plant, 100-kernels weight, shell weight, shelling percentage and pod yield per plant. The inter correlation among these traits also has significant association. Hence, these traits may be considered as selection indices for oil yield improvement programme in groundnut.

References

Cherry, J.P. 1977. Potential sources of peanut seed proteins and oil in the Genus Arachis. *J. Agric. Food Chem.,* **25:**186-193.

Dhaliwal, G.P.S., Nagda, A.K. and Mittal, V.P. 2010. Intertrait associations and path analysis studies in groundnut (*Arachis hypogaea* L.). *Crop Improv.,* **37(1):** 57 - 60.

Jogloy, C., Jaisil, P., Akkasaeng, C., Kesmala, T. and Jogloy, S. (2010). Heritability and correlation for components of crop partitioning in advanced generations of peanut crosses. *Asian J. Plant Sci.,* (in press).

John, K., Vasanthi, R.P. and Venkateswarlu, O. 2008. Estimates of genetic parameters and character association in F_2 segregating populations of *Spanish* x *Virginia* crosses of groundnut (*Arachis hypogaea* L.). *Legume Res.,* **31(4):** 235-242.

John, K., Vasanthi, R.P. and Venkateswarlu, O. 2009. Studies on variability and character association in Spanish bunch groundnut (*Arachis hypogaeae* L.). *Legume Res.,* **32 (1):**65-69.

Khanpara, M.D., Shinde, P.P., Jivani, L.L., Vachhani, J.H., and Kachhadia, V.H. 2010. Character association and path coefficient analysis in groundnut (*Arachis hypogaea* L.). *Plant Arch.,* **10(2):** 695 - 698.

Korat, V. P., M. S. Pithia, J.J. Savaliya, A.G. Pansuriya and Sodavadiya, P.R. 2010. Studies on characters association and path analysis for seed yield and its components in groundnut. (*Arachis hypogaea L.*). *Legume Res.,* **33(3):** 211-216.

Kotzamanidis, S.T., Stavropoulos, N. and Lpsilandis, C.G. 2006. Correlation studies of 21 traits in F_2 generation of groundnut (*Arachis hypogaea* L.). *Pak. J. Biol. Sci.,* **9(5):** 929-934.

Kumar, D.R., Sekhar, M.R., Reddy, K.R. and Ismail, S. 2012. Character association and path analysis in groundnut (*Arachis hypogaea* L.). *Int. J. Appl. Biol. Pharm. Technol.,* **3(1):** 385 - 389.

Ladole, M.Y., Wakode, M.M. and Deshmuk, S.N. 2009. Genetic variability and character association studies for yield and yield contributing traits in groundnut. *J. Oilseeds Res.,* **26 (Special Issue):** 123-125.

Layrisse, A., Wynne, J. C. and Isleib, T.G. 1980. Combining ability for yield, protein and oil of peanut lines from South American Centers of diversity. *Euphytica,* **29:**561-570.

Lus, N.D.L., Cavalcanti, S.D.R. and Albuquerque, M.F.P. 2011. Correlations and path analysis of peanut traits associated with the peg. *Crop Breeding & Applied Biot.* **11(1):** 88-93.

Mahalakshmi, P., Manivannan, N. and Muralidharan, V. 2005. Variability and Correlation studies in Groundnut (Arachis hypogaea L.). *Legume Res.,* **28(3):**194-197.

Mohinder Singh, Raheja, R.K., Ahuja, K.L. and Sharma, S.R. 2000. Correlation between pod yield and quality characters in groundnut (*Arachis hypogaea* L.) types. In: Proceedings of the National Seminar on Oilseeds and Oils – Research and Development Needs in the Millennium, DOR, Hyderabad. p. 331-332.

Nagda, A.K., Dashora, A. and Jain, D.K. 2001. Character association in parents and hybrids of groundnut (*Arachis hypogaea* L.). *Crop Res., (Hissar).* **22 (3):** 463-468.

Narasimhulu, R., Kenchanagoudar, P.V. and Gowda, M.V.C. 2012. Study of genetic variability and correlations in selected groundnut genotypes.*Int. J. Appl. Biol. Pharm. Technol.,* **3(1):** 355 - 358.

Pradhan, K. and Patra. R.K. 2011. Variability and correlation studies on groundnut (*Arachis hypogaeae* L.) germplasm. *Legume Res.,* **34(1):** 26 - 30.

Priyadharshini, M. 2012. Molecular marker analysis for yield and yield component traits under non stress and drought stress conditions in groundnut (*Arachis hypogaea* L.). Unpublished Ph.D. (Ag.) Thesis. Submitted to the Tamil Nadu Agricultural University, Coimbatore.

Sadeghi, S.M. and Niyaki, S.A.N. 2012a. Correlation and path coefficient analysis in peanut (*Arachis hypogaea* L) genotypes under drought stress and irrigated conditions. *Annl. Biol. Research,* **3 (6):** 2593-2596.

Sadeghi, S.M. and Niyaki, S.A.N. 2012b. Genetic correlation and path-coefficient analysis of oil yield and its components in peanut (*Arachis hypogaea* l.) genotypes under drought and non-drought stress condition. *J. Basic. Appl. Sci. Res.,* **2(7):** 6561-6565.

Sangha, A.S., Labana, K.S. and Singh, M. 1990. Genetic analysis in a cross of runner and bunch groundnut. *Crop Improv.,* **17**(2): 186-187.

Sharma, H. and Dashora, A. 2009. Character association and path analysis in groundnut, *Arachis hypogaea* L. *J. Oilseeds Res.,* **26 (Special Issue):** 614-616.

Vaithiyalingan, M., Manoharan, V. and Ramamoorthi, N. 2010. Association analysis among the yield and yield attributes of early season drought tolerant groundnut (*Arachis hypogaea* L.). *Electron. J. Plant Breed.,* **1(5):** 1347-1350.

Vasanthi, R.P., Naidu, P.H. and Rao, A.S. 1998. Inter-relation among yield, yield attributes and late leaf spot severity in groundnut. *J. Oilseeds Res.,* **15(2):** 383 - 385.

Venkataramana, P., Shankaranarayana, V., Sheriff, R.A. and Kulkarni, R.S. 2000. Contribution of different characters towards pod yield in groundnut (*Arachis hypogaea* L.) under different environments. In: Proceedings of the National Seminar on Oilseeds and Oils – research and Development Needs in the Millennium, DOR, Hyderabad. P. 96.

Zaman, M.A., Khatun, M.T., Ullah, M.Z., Moniruzzamn, M. and Alam, K.H. 2011. Genetic Variability and Path Analysis of Groundnut (*Arachis hypogaea* L.). *The Agriculturists,* **9(1&2):** 29-36.

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