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Jhansi Veluri *, Srividhya A, Sabitha N, Latha P

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Correlation Analysis Among Yield and Its Component Traits in F_2 Population of Groundnut (*Arachis hypogaea* L.) Derived from TCGS 1694 × ICGV 201179

Jhansi V [1,*], Srividhya A [2], Sabitha N [1] and Latha P [3]

[1] Dept. of Genetics and Plant Breeding, S.V. Ag. College, ANGRAU, Tirupati, 517 502.
[2] Groundnut Breeding Section, IFT, RARS, ANGRAU, Tirupati 517502.
[3] Department of Crop physiology, S.V. Ag. College, ANGRAU, Tirupati, 517 502.
* Correspondence: jhansiveluri213@gmail.com

Abstract

Groundnut (*Arachis hypogaea* L.) is a vital oilseed crop cultivated extensively for its economic and nutritional value. Enhancing pod yield remains a key objective in groundnut breeding programs. In the present study, an F_2 population derived from the cross TCGS 1694 × ICGV 201179 was evaluated at the Regional Agricultural Research Station (RARS), Acharya N.G. Ranga Agricultural University (ANGRAU), Tirupati, Andhra Pradesh, during the *kharif* season of 2024. The objective was to assess the correlation among seven yield and yield-attributing traits to identify potential selection criteria for improving pod yield. The analysis revealed that pod yield per plant exhibited a highly significant positive correlation with seed yield per plant, followed by number of pods per plant, number of seeds per plant, hundred pod weight, hundred seed weight, and shelling out-turn percentage. These findings suggest that these traits are closely associated with pod yield and can be effectively utilized as indirect selection indices in the advancement of high-yielding groundnut genotypes.

Keywords: groundnut; correlation; yield and yield-attributing traits

Introduction

Groundnut (*Arachis hypogaea* L.) is the major oilseed crop of India. It belongs to subfamily Papilionaceae of family Leguminosae and is highly self-pollinated due to cleistogamous flowers. It is an important cash crop for the farmers of the arid and semi-arid tropics, where most of the peanut cultivation is concentrated (Janila *et al.,* 2016). Groundnut is a significant source of oil (45 to 50%), carbohydrates (20%), fibre, magnesium, zinc, folacin, potassium, calcium, phosphorus, iron, vitamins and three forms of fat-soluble tocopherols (α, γ and δ) hence, it is called "poor man's almond" and play a key role in combating malnutrition (Mukri *et al.,* 2014).

In India Groundnut is grown in an area of 5.396 M ha with a production of 11.31 Mt and productivity of 2,097 kg ha^{-1} and in Andhra Pradesh, it is grown in an area of 0.346 Mha and producing 0.360 Mt and the productivity on average is 1041 kg ha^{-1} (INDIASTAT, 2024-2025). Obtaining high yielding groundnut varieties is of prime importance to ensure food security needs.

Yield is a complex trait governed by many component characters with considerable degree of association in both positive and negative directions. Determining the relationship between yield and its constituent traits is extremely valuable since it serves as the foundation for selection. correlation is the biometrical technique that can be used to assess how strongly the character pairs are associated and to identify potential selection criteria for a breeding program. The present investigation was carried out to assess the nature and magnitude associations between pod yield and its component characters in F_2 generation of groundnut.

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Materials and Methods

The experimental material comprised 244 F_2 plants derived from the cross TCGS 1694 × ICGV 201179, developed and provided by the Groundnut Breeding Department, Regional Agricultural Research Station (RARS), ANGRAU, Tirupati. The field experiment was conducted at the Dryland Farm of RARS, ANGRAU, Tirupati, Andhra Pradesh, during the kharif season of 2024. Sowing was undertaken on 1st August 2024. The parental lines, TCGS 1694 and ICGV 201179, were sown on either side of the F_2 population—TCGS 1694 on the right and ICGV 201179 on the left—to facilitate comparative evaluation.

The F_2 population was sown in rows of 4 meters in length, with a spacing of 30 cm between rows and 10 cm between plants within the row. Standard agronomic practices were followed throughout the crop growth period to ensure optimal plant development.

Phenotypic observations were recorded on all 244 individual F_2 plants for the following traits: number of pods per plant, pod yield per plant (g), number of seeds per plant, seed yield per plant (g), shelling out-turn (%), hundred pod weight (g), and hundred seed weight (g). Correlation analysis among these traits was performed using OPSTAT statistical software to identify relationships contributing to yield improvement.

Results and Discussion

Correlation coefficients among yield and yield-related traits in the F_2 population of the cross TCGS 1694 × ICGV 201179 were computed and presented in Table 1. The analysis revealed that pod yield per plant exhibited a highly significant and strong positive correlation with several key traits, including seed yield per plant (r = 0.954**), number of pods per plant (r = 0.940**), number of seeds per plant (r = 0.931**), hundred pod weight (r = 0.392**), hundred seed weight (r = 0.225**), and shelling out-turn (r = 0.131*). These associations suggest that these traits are directly and mutually associated with pod yield, making them important selection criteria for enhancing productivity in groundnut. Similar findings were reported by Prabhu *et al*. (2015), Devi *et al*. (2018), Wadikar *et al*. (2018), Kumar *et al*. (2019), Khan *et al*. (2022), Yadav *et al*. (2023), and Vaghasiya *et al*. (2025). The positive correlation of pod yield with hundred pod weight aligns with results from Adlak (2019) and Vargheese *et al*. (2024), while its association with shelling out-turn is consistent with Saritha *et al*. (2018).

Table 1. Pearson correlation coefficients among yield and yield-attributing traits in the F_2 population of the cross TCGS 1694 × ICGV 201179.

	NPP	PYP	NSP	SYP	SOT	HPW	HSW
NPP	1.000	0.940**	0.929**	0.867**	0.011	0.119	0.039
PYP		1.000	0.931**	0.954**	0131*	0.392**	0.225**
NSP			1.000	0.923**	0.215**	0.251**	-0.014
SYP				1.000	0.374**	0.442**	0.297**
SOT					1.000	0.392**	0.391**
HPW						1.000	0.657**
HSW							1.000

= Significance at 5% level; *= Significance at 1% level. **NPP: Number of pods plant^{-1}, **PYP**: Pod yield plant^{-1} (g), **NSP**: Number of seeds plant^{-1}, **SYP:** Seed yield plant^{-1} (g), **SOT**: Shelling out-turn (%), **HPW**: Hundred pod weight (g), **HSW**: Hundred seed weight (g).

The number of pods per plant showed a strong positive and highly significant correlation with number of seeds per plant (r = 0.929**) and seed yield per plant (r = 0.867**), reinforcing their collective importance in yield improvement. These results corroborate previous findings by Anitha *et al*. (2014), Jain *et al*. (2016), Reddy *et al*. (2017), Hampannavar *et al*. (2018), Wadikar *et al*. (2018), Khan *et al*. (2022), Gali *et al*. (2023), Yadav *et al*. (2023), and Vaghasiya *et al*. (2025). However, number of pods per plant

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showed a non-significant and weak positive association with hundred pod weight (r = 0.119), hundred seed weight (r = 0.039), and shelling out-turn (r = 0.011). Similar trends were reported by Sravanthi *et al*. (2024) and Vaghasiya *et al*. (2025).

The number of seeds per plant showed a highly significant positive correlation with seed yield per plant (r = 0.923**), hundred seed weight (r = 0.251**), and shelling out-turn (r = 0.215**), whereas a non-significant negative correlation was observed with hundred pod weight (r = -0.014).

The seed yield per plant had a strong positive and highly significant association with hundred seed weight (r = 0.442**), shelling out-turn (r = 0.375**), and hundred pod weight (r = 0.297**). These findings are supported by Prabhu *et al*. (2015), Reddy *et al*. (2017), Khan *et al*. (2022), and Vaghasiya *et al*. (2025) for hundred seed weight; by Anitha *et al*. (2014), Jain *et al*. (2016), Hampannavar *et al*. (2018), Khan *et al*. (2022), and Yadav *et al*. (2023) for shelling out-turn; and by Kumari and Sasidharan (2020) for hundred seed weight.

Shelling out-turn exhibited a moderate but highly significant positive correlation with hundred pod weight (r = 0.392**) and hundred seed weight (r = 0.391**). These results are consistent with Suvarna (2020), Prabhu *et al*. (2015), Kannappan *et al*. (2022), and Kumar (2023).

Lastly, a highly significant positive association was observed between hundred pod weight and hundred seed weight (r = 0.657**), which is in agreement with findings of Anitha *et al*. (2014), Prabhu *et al*. (2015), Kumar *et al*. (2019), Kannappan *et al*. (2022), Kumar (2023), and Sravanthi *et al*. (2024).

These interrelationships highlight the importance of pod and seed traits in yield improvement and provide a robust basis for the selection of promising segregants in early generations.

Conclusion

The present investigation on the F_2 population derived from the cross TCGS 1694 × ICGV 201179 revealed significant genetic variability and strong positive correlations among key yield and yield-attributing traits. Pod yield per plant showed highly significant and positive associations with seed yield per plant, number of pods per plant, number of seeds per plant, hundred pod weight, hundred seed weight, and shelling out-turn, indicating their direct contribution to yield improvement. These traits can thus serve as effective selection indices in early-generation breeding for enhancing productivity in groundnut. The identified relationships provide valuable insights for groundnut breeders to formulate effective selection strategies and accelerate the development of high-yielding genotypes through phenotypic selection.

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