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Character Association Analysis of Yield, Yield Attributing and Kernel Micronutrient (Iron and Zinc) Traits in Groundnut (*Arachis hypogaea* L.)

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Abstract

The field experiment was carried out at Dry land farm, Regional Agricultural Research Station (RARS), Tirupati during *kharif*, 2024 to study the correlation analysis ofyield, yield attributing and kernel micronutrient traits in groundnut. The plant material includes 20 diverse groundnut genotypes along with Rohini, as a check for kernel micronutrient content were considered for evaluating eleven traits which include kernel yield plant^{-1}, pod yield plant^{-1}, 100 pod weight, 100 kernel weight, kernel mass, shelling percentage, soundmature kernel percentage, kernel length, kernel breadth, iron and zinc content.Character association studies revealed that pod yield plant^{-1} showed positive and significantassociation with kernel yield plant^{-1}, 100 pod weight, 100 kernel weight, and kernel length, sound mature percent.This indicates that these traits play a crucial role in the selection of genotypes for improving pod yield.

Keywords: groundnut; character association; pod yield; yield traits

Introduction

Groundnut, is one of the most important oilseed crop grown in India. It is commonly known as peanut, goober nut, earth nut, monkey nut etc., depending on the location in which it is grown. The plant is a legume, native to South America primarily in the tropical areas of Peru. The cultivated groundnut (*Arachis hypogaea* L.) is a self-pollinating, allotetraploid species with a chromosome number of 2n=4x=40. It is a member of the leguminosae family and the papilionaceae sub-family. Major groundnut-producing countries globally include India, China, the USA, West Africa, Sudan, Nigeria, and others.

Groundnut is cultivated over 32.7million hectares worldwide, resulting in the production of 53.9 million tonnes and an average productivity of 1,648 kgha^{-1} (FAOSTAT, 2023). India ranks second among groundnut producing countries with an area of 539mha, production of 11.3mt and productivity of 2,097 kgha^{-1} and in Andhra Pradesh, it is cultivated in an area of 0.346mha with a production of 0.360 mt and average productivity of 1041 kgha^{-1} (INDIASTAT, 2024-2025).

In groundnut, pod yield is a complex quantitative trait influenced by multiple physiological and yield-contributing components. Due to its polygenic nature and strong environmental interactions, direct selection for pod yield is often unreliable. Instead, understanding the interrelationships among yield components through correlation analysis offers a more strategic approach to selection in breeding programs. The present investigation was undertaken in this context to study the character associations between yield components and quality traits on pod yield with a view to identify effective selection criteria for higher pod yield in groundnut.

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Material and Methods

The present investigation was carried out during *kharif,* 2024 at Dry land farm, Regional Agricultural Research Station (RARS), Tirupati, Andhra Pradesh. The experimental material utilized for the present study comprised of twenty diverse groundnut genotypes along with check Rohini for kernel iron and zinc content were raised in Randomised Block Design with two replications. Each genotype was sown in two rows of three metres length with a spacing of 30 cm between rows and 10 cm between plants within the row. All necessary cultural operations along with proper plant protectionmeasures were taken to control insect pests.Observations recorded from randomly chosenfive competitive plants in each genotype for elevencharacters *viz.*, kernel yield plant^{-1}, pod yield plant^{-1},100 pod weight, 100 kernel weight, kernel mass,shelling percentage, sound mature kernel percentage,kernel length, kernel breadth, iron and zinc content.

Genotypic and phenotypic correlation coefficients between the measured traits were calculated employing R software.

Results and Discussions

The pod yield plant^{-1} showed positive and significant correlation with kernel yield plant^{-1} (r_p= 0.978, r_g = 0.979) at both phenotypic and genotypic levels. Similar results were reported in findings of Pachauri andSikarwar (2023), Patel *et al*. (2021), and Kumar et al. (2014).

Significant association of hundred pod weight(r_p= 0.484, r_g= 0.579) and hundred kernel weight (r_p= 0.364, r_g=0.491) with pod yield plant^{-1} were in conformity with the findings of John *et al*. (2009), Korat et al. (2010).

The pod yield plant^{-1} showed significantly positive correlation with kernel length at genotypic level (r_g= 0.530), and significantly negative correlation with Fe content at both phenotypic and genotypic levels (r_p= -0521, r_g= -0.701).

Kernel yield plant^{-1}showed significantly positive correlation with 100 pod weight, 100 kernel weight (r_p =0.370, r_g=0.514) both at phenotypic and genotypic levels. similar results were reported by Shoba et al. (2012), Mahesh et al. (2018).

Kernel yield per plant^{-1}also showed a significantly negative correlation with Fe content both at phenotypic and genotypic levels (r_p =-0.472, r_g=0.621). This may be attributed to the increased kernel yield, which could lead to competition for nutrients, thereby reducing nutrient allocation to individual seeds.

100 pod weight showed significantly positive correlation with 100 kernel weight (r_p= 0.513, r_g= 0.935), kernel breadth (r_p= 0.530, r_g= 0.731), kernel mass (r_p= 0.469, r_g= 0.743), and showing positively significant correlation with sound mature kernel and kernel length only at genotypic level (r_g= 0.592), (r_g= 0.467), and also showing significantly negative correlation with Fe content (r_p= -0.343, r_g=- 0.507). Similar results were reported by Pachauri and Sikarwar (2022), for 100 kernel weight and with kernel breadth and kernel mass and kernel length was reported by Bhargavi *et al*. (2017) and Mitra *et al*. (2021)

100 kernel weight showed positive and significant correlation only at genotypic level with sound mature kernel percent (r_g =0.490), high positive and significant correlation with kernel breadth (r_p= 0.471, r_g= 0.707), kernel mass (r_p= 0.760, r_g= 0.974) and kernel length (r_p= 0.463, r_g= 0.779) both at phenotypic and genotypic levels. This indicates a strong genetic linkage between SMK, kernel length, breadth, and mass with 100 kernel weight, making them key traits in selection programs (Gali *et al*., 2023).

Shelling percentage showed negatively significant correlation with kernel length only at phenotypic level (r_p= -0.420), and showed non significantly positive correlation with sound mature kernel %, kernel breadth and Fe content. Patil et al. (2006) reported a positive correlation of shelling percent with sound mature kernel percent.

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Sound mature kernel percent was observed positively associated with kernel breadth, kernel mass and pod yield plant^{-1}. Thakur *et al*. (2013) also reported association of sound mature kernel with kernel breadth and kernel yield plant^{-1}.

Kernel length showed high positive and significant correlation with kernel mass at both phenotypic and genotypic levels (r_p= 0.633, r_g= 0.980). This indicates that longer kernels tend to be heavier, confirming both **phenotypic**(observable traits) and **genotypic** (inherent genetic influence) associations as hundred-kernel weight is significantly associated with related traits including kernel length, according to Gali *et al*. (2023). Kernel length showed negative non significant correlation with Fe content.

Kernel breadth showed significantly positive correlation with kernel mass at both phenotypic and genotypic levels (r_p= 0.478, r_g= 0.525). This indicates selection of wider kernels is an effective strategy to improve kernel weight and overall yield. Kernel breadth showed non significant negative correlation with zinc content.

Iron content showed negative non significant correlation with zinc content. Sukrutha *et al*. (2022), Ankita *et al*. (2023) reported similar results in groundnut. Zinc content showed non significant positive correlation with kernel yield plant$^{-1.}$

Conclusions

To improve the pod yield plant^{-1} the traits such askernel yieldplant$^{-1.}$, 100 pod weight, 100 kernel weight can be taken as selection criteria, which further helps in the development of high yielding genotypes in groundnut.Similarly, for enhancing the100 kernel weight and 100 pod weight the traits kernelmass, sound mature kernel, kernel lengthand kernelbreadth should be given dueimportance.Thus, the genotypes that showed high 100 podweight, 100 kernel weight, kernelmass, kernel breadth, kernel length inthe study playscrucial role in the selection of genotypes for sustainable improvement of pod yield.

Table 1. Phenotypic and genotypic correlation analysis for yield, yield attributing andmicronutrient (iron, zinc) contents in groundnut.

Trait		KYP	100PWT	100KWT	SP	SMK	KL	KB	KM	IC	ZC	PYP
KYP	p	**1.000**	0.484 **	0.370 *	0.216	0.145	0.135	0.229	0.292	-0.472 **	0.074	0.978 **
	g	**1.000**	0.645 **	0.514 *	0.260	0.232	0.410	0.283	0.416	-0.621 **	0.046	0.979 **
100PWT	p		**1.000**	0.513 **	0.161	0.232	0.246	0.530 **	0.469 **	-0.343 *	-0.111	0.448 **
	g		**1.000**	0.935 **	0.199	0.592 **	0.467 *	0.731 **	0.743 **	-0.507 *	-0.374	0.579 **
100KWT	p			**1.000**	0.021	0.278	0.463 **	0.471 **	0.760 **	-0.170	-0.240	0.364 *
	g			**1.000**	0.032	0.490 *	0.779 **	0.707 **	0.974 **	-0.368	-0.354	0.491 *
SP	p				**1.000**	0.266	-0.420 **	0.237	-0.081	0.234	-0.134	0.038
	g				**1.000**	0.336	-0.429	0.244	-0.113	0.252	-0.214	0.035
SMK	p					**1.000**	-0.039	0.254	0.171	0.071	-0.188	0.105
	g					**1.000**	-0.120	0.402	0.202	-0.121	-0.424	0.162
KL	p						**1.000**	-0.053	0.633 **	-0.220	0.116	0.204
	g						**1.000**	0.046	0.980 **	-0.328	-0.009	0.530 *
KB	p							**1.000**	0.478 **	-0.244	-0.248	0.165
	g							**1.000**	0.525 *	-0.430	-0.313	0.215
KM	p								**1.000**	-0.253	-0.054	0.309
	g								**1.000**	-0.380	-0.065	0.435
IC	p									**1.000**	-0.019	-0.521 **
	g									**1.000**	-0.001	-0.701 **
ZC	p										**1.000**	0.113
	g										**1.000**	0.108
PYP	p											**1.000**
	g											**1.000**

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P*=<0.001,P**=<0.01,P*=<0.05.** PYP- Pod Yield Plant^{-1}, 100 PW- Hundred pod weight, 100KW-Hundred kernel weight, KYP-Kernel Yield Plant^{-1}, KM-Kernel Mass, SP- Shelling Percent, SMK- Sound Mature Kernel, KL-Kernel Length,KB-Kernel Breadth , IC- Iron content, ZC- Zinc content.

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