



Peanut (*Arachis hypogaea* L.) Growth and Straw Yield as Influenced by Various Seed Types per Hill and Hill Spacing (Plant Population)

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Abstract

In order to study the effect of plant population on yield and its components of Groundnut, an experiment was conducted in complete randomized blocks design with four replications at Research Farm of New Halfa Research Station during summer seasons of 2016 and 2017. Experimental factors including: Type of seeds (shelled and unshelled), spacing (5, 10 and 15cm) and seed number (1, 2 and 3 Seeds or pods/hole) which combination to (285714, 571428, 857143, 142827, 428571, 95238 and 190476 plants/ha). The results revealed that, particularly in first season, the closer spacing between hills increased plant height, biological yield, as well as straw yield but number of fruited branches was increased in wider spacing. It can be concluded that, sowing either shelled or unshelled groundnut seeds at higher plant populations resulted in increased growth attributes and straw yield in this study.

Keywords: Groundnut growth, straw yield, plant population, shelled and unshelled seeds

Introduction

Peanut (*Arachis hypogaea* L.) is one of the commodities of food crops that have a high economic value and preferred by community due to the content of its nutrition value especially the high protein and fat [Simanjuntak, N. *et al.*, 2014]. Groundnut is the king of oilseed crops plays a vital role in the economy of national edible oil. Worldwide groundnut is cultivated in more than 100 countries on an area of 26.4 million hectares with total production of 37.1 million metric tonnes and an average productivity of 1.4 metric t ha⁻¹ [Gadade, G. D. *et al.*, 2018]. Also, [Rasekh, H. *et al.*, 2010] indicated that peanut growth depends on the magnitude of management variability and practices, especially those which concerned with plant spacing, even between and/or within plants. The number of plant per unit area is one of the most important yield determinants of field

crops. So that planting density is one of the main factors that have an important role on growth, yield and quality of peanut. Optimum spacing ensures proper growth of the aerial and underground parts of the plant through efficient utilization of solar radiation, nutrients, water, land as well as air spaces [Miah, M. N. H. *et al.*, 1990]. Recently, [Awal, M. A. *et al.*, 2015] concluded that, it was evident that the row spacing exerted a significant role on plant height. The taller plant was found from the closest row spacing (i.e. 15 cm) as compared to wider row spacing as in the order of 15 > 20 > 25 > 30 > 35 cm throughout the growing season. Among the plant populations tested, the growth parameters viz., plant height, DMP and biological yield were significantly higher at plant population of 6.66 plants/ha [Bhagavatha, T. P. *et al.*, 2016]. Several researches have been conducted to

study the growth and yield of groundnut by modifying cultural practices worldwide including [Mohammed, Y. E. et al., 2018] in Sudan who reported that, improper plant spacing and plant density affect the normal physiological activities of the crop.

Planting density is one of the main factors that plays an important role on growth of any crop, sub optimal plant stand in groundnut has been identified as one of the major constraints to realize full production potential. Hence, optimum plant population is required for better utilization of growth resources like light, moisture and nutrients, which consequently reduces the risk of biological yield reduction and ensures higher productivity and returns per unit area. Groundnut information on plant spacing and plant population in irrigated New Halfa Scheme is scanty because not much work has been done on the crop since cultivation of it is very poor in the area of study. Thus, a field experiment on the effect of plant population on the growth characters and straw yield of groundnut in this area was done to ascertain the best plant population for New Halfa for recommendation area. This will encourage farmers in the area to embark on the cultivation of the crop in question particularly, most of these farmers have domesticated animals (cows, sheep and goats) and they need straw of ground nut as alternative feed for their animals.

Materials and Methods

In order to study the effect of plant population on yield of groundnut (*Arachis hypogaea* L.), an experiment was conducted as factorial with complete randomize blocks design with four replications at Research Farm of New Halfa Research Station during two summer seasons of 2016 and 2017. Experimental factors including: Type of seeds (shelled and unshelled), plant population as spacing (5, 10 and 15cm) and number of seeds (Single, two and three Seeds or pods/hole).The different spacing and seeds/hill combination resulting in the following plant population in (table 1). Seeds of groundnut (variety Medani) were sown on first week of July during two seasons. At maturity: Ten plants of each plot randomly selected and tagged to measure the following attributes: plant height Number of fruited branches/plant, total biological yield and Total straw yield per hectare.

Statistical analysis

Data collected subjected to statistical analysis as described by [Gomez, K. A. et al., 1984] using STATISTICS statistical package (version 10). The analysis of variance procedure for multifactor experiments were followed to determine whether differences existed among treatments. All treatments were compared using the Duncan Multiple Range Test (DMRT) at 5 % probability level. Also, the relationship between these characters was determined by SPSS statistical package (version 20).

Table 1: The different spacing and seeds/hill combination resulting in the following plant population

distances between hills	5cm	5cm	10cm	5cm	10cm	15cm	15cm	10cm	15cm
seeds/hill(no)	3	2	3	1	2	3	2	1	1
Plants/ha(no)	857143 (D1)	571428 (D2)	4285714 (D3)	285714 (D4)	285714 (D4)	285714 (D4)	190470 (D5)	142827 (D6)	95238 (D7)

Results and Discussion

Plant height is important growth parameter which is influenced by the agronomic and environmental factors. Sowing shelled seeds significantly increased the plant height particularly at closer spacing between hills as

compared with sowing unshelled seeds at the same spacing. However, the closer spacing between hills increased the plant height in the both seasons (Fig.1). The increase of growth characters resulted from spacing effects, due to more factor, the moisture contain to be

reliable to the plant at end increased the plant frame. Reducing spacing between hills resulted in increasing competition for light at high plant population; this led to increased plant height of the groundnut. Hence plants were compelled to grow more in upward direction for the fulfillment of light requirement for photosynthesis. The results

are in conformity with these reported by [Basha, H. A. et al., 1994; Gadade, G. D. et al., 2018]. Also, the result is in agreement with that of [Jyothi, M. R. et al., 2004; Hossain, M. M. et al., 2005] who observed that peanut's plant height was significantly increased with higher plant densities.

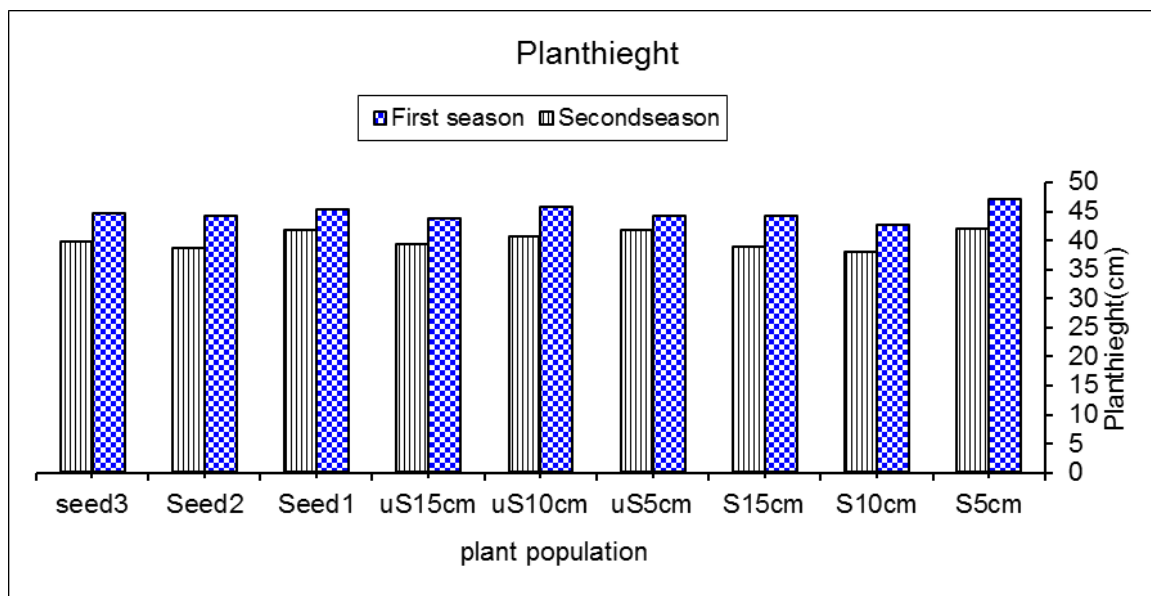


Fig 1: Plant height as influenced by Various Seed Types per Hill and Hill Spacing (Plant Population)
 S≡shelled seed; US≡ unshelled seed; 5,10,15 cm ≡ spaces between hills; Seed1≡one seed/hill;
 Seed2≡2seeds/hill and Seed3≡ 3seeds/hill

Generally, increasing spacing between hills gave groundnuts plants with highest numbers of branches bearing fruits. In this regard, sowing shelled seeds resulted in increase of the numbers of branches bearing fruits at the same spacing as compared with sowing unshelled seeds (Fig.2). the numbers of branches/plant are reduced proportionally with an increase in plant density. At low plant density, existing plants developed more branches because of reduced in competition.

The result is in agreement with, [Basha, H. A. et al., 1994; El-Far, I. A. et al., 2000], in Egypt, who found that, increasing the distances between hills from 10 to 30 cm caused significant increase in number of branches per plant. Also, [Hossain, M. M. et al., 2005] found that branch number per groundnut plant was greater in wider spacing as compared to closer one which commensurate the present result.

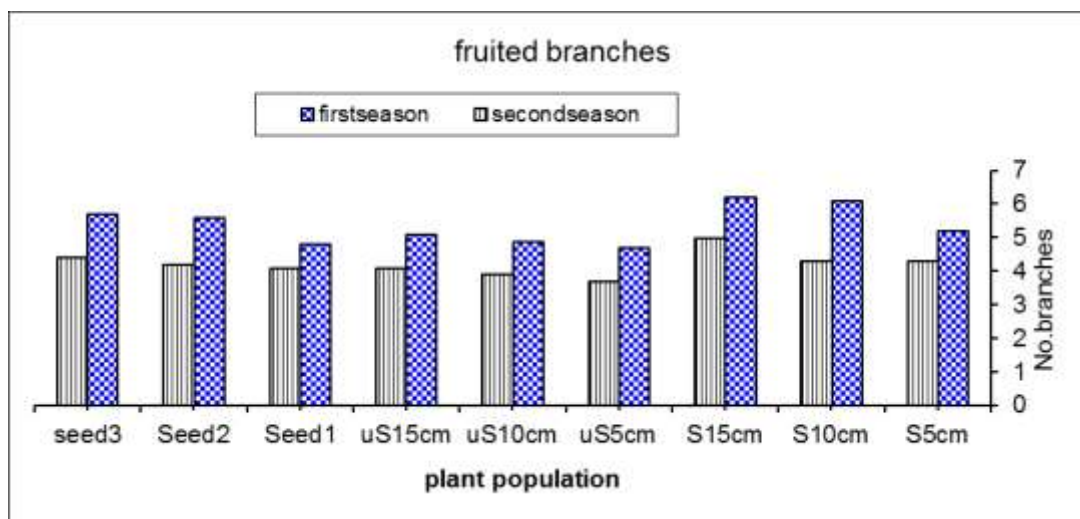


Fig 2: Number of fruited branches per plant as influenced by Various Seed Types per Hill and Hill Spacing (Plant Population)

In both seasons, sowing shelled seeds increased the biological yield at all different distances between hills (Fig.3). However, biological yield resulted from closer spacing 5cm was as par as that resulted at 10 cm spacing but greater than that produced from wider spacing in the two seasons. Similar result was reported by [Awal, M. A. et al., 2015] who stated that, The highest biological

yield was recorded from the crop grown with 15 or 20 cm spacing whereas the lowest biological yield was obtained from the spacing of 30 or 35 cm. Also, [Gabisa, M. et al., 2017] reported that, there was significant effect of plant density on above ground dry biomass, and the highest above ground dry biomass (6050 kg ha⁻¹) recorded at the highest plant density of (333333 plants ha⁻¹).

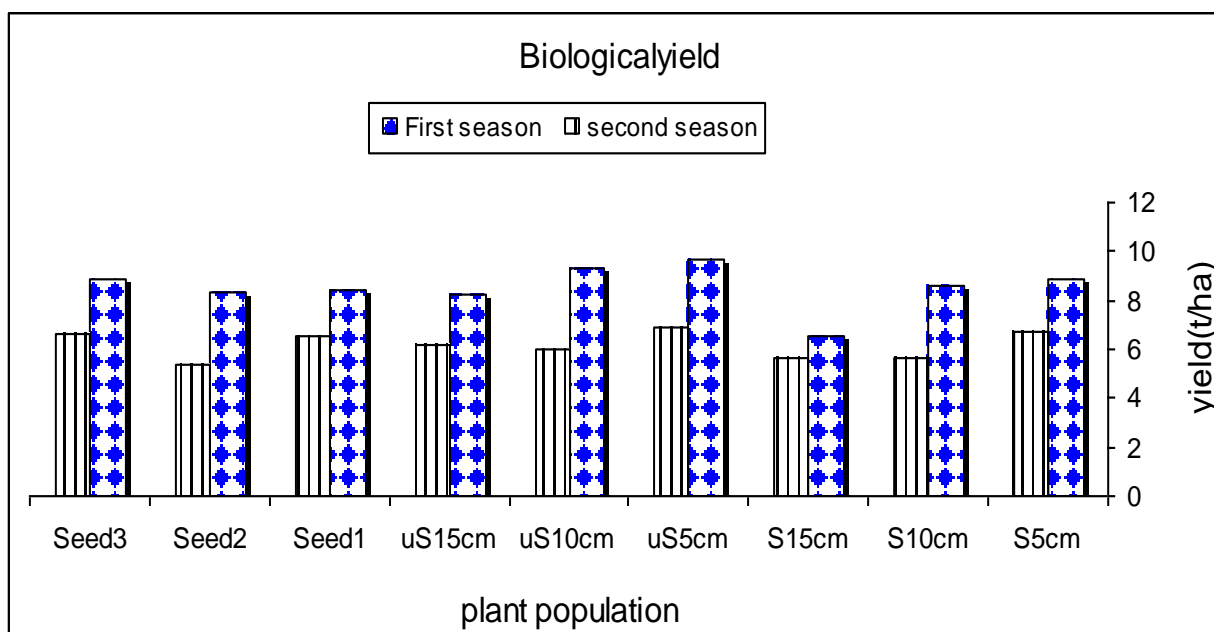


Fig 3: Biological yield (g/plant) as influenced by Various Seed Types per Hill and Hill Spacing (Plant Population)

Furthermore, For instance, when sowing unshelled seeds, there may be an increase in the time between seed germinating and seedling emergence which largely determines

by ranking of seedling in the competitive hierarchy for resources, therefore, the reduction in growth attributes in this study

due to sowing unshelled seeds could be attributed to aforementioned reasons.

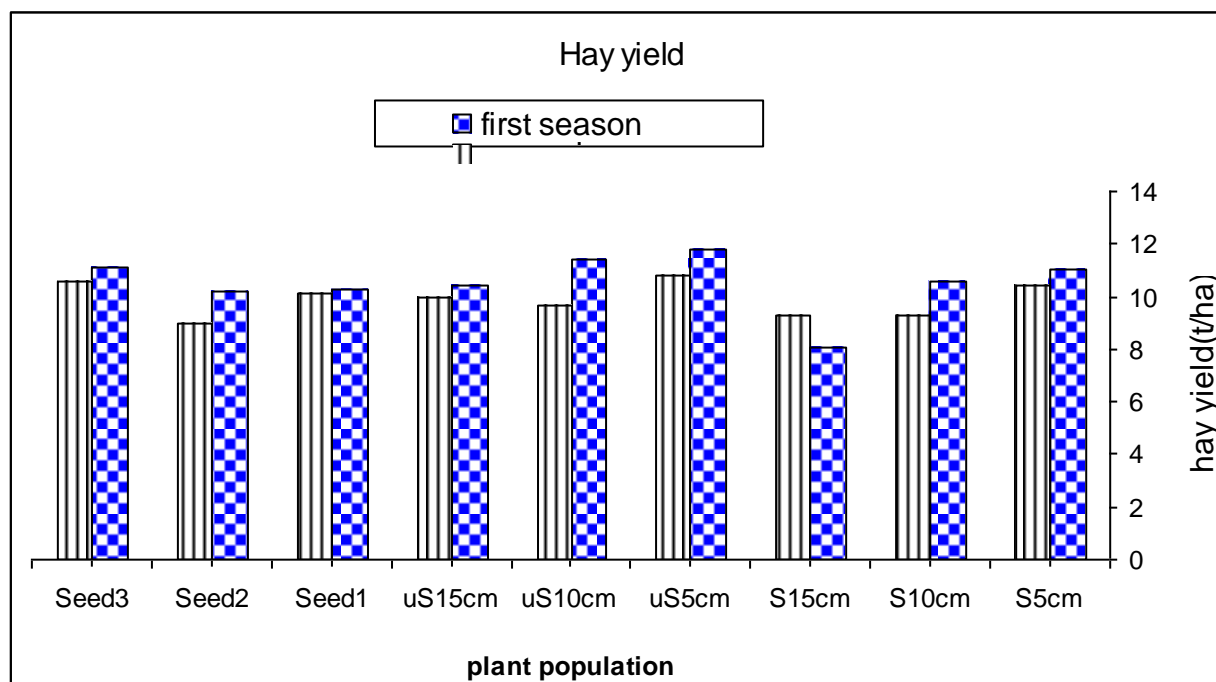


Fig 4: Straw yield (ton/ha) as influenced by Various Seed Types per Hill and Hill Spacing (Plant Population)

Correlation Analysis

The significant positive correlation coefficient ($p \leq 5\%$) was observed between straw yield with plant height and biological yield. The stronger significant positive correlation also, was observed between plant height and

biological yield. While medium significant positive correlation relationships were observed between number of fruited branches, plant height and biological yield, respectively (table 2).

Table 2: correlation coefficient

	Plant height	Fruited branches	biological yield
Fruited branches	0.544*		
biological yield	0.867**	0.494*	
hay yield	0.512*	-0.047 ^{NS}	0.782**

Sowing shelled seeds significantly increased the hay yield per unit area particularly at closer spacing between hills as compared with sowing unshelled seeds at the same spacing. Also, increasing number of seeds per hill significantly increased the straw yield per unit area in the both seasons (Fig.4). Hence the higher plant population resulted in increased of straw yield might be due to increase of biological yield in this study, which was confirmed with the significant

positive correlation coefficient between straw yield and biological yield. Also, maximum straw yield per hectare was recorded in plots where spacing between plants was closer this might be due to more number of plants per hectare. Moreover, the improve in all measured characters observed in the first season as compared to results in the second season could be due attributed to the favorite climatic conditions in the first season (Appendix 1).

Appendix 1: Climate data during the two seasons

Months of the years		Jun	Jul	Aug	Sept	Oct	Nov	Dec
2016	Temperature °C	40.5	36.5	34.5	35.5	35.5	34.0	30.0
	Rain(mm)							
2017	Temperature °C	41.7	39.6	39.8	934.	34.5	34.8	31.9
	Rain(mm)							

Conclusion

It can be concluded that, sowing either shelled or unshelled groundnut seeds at higher plant population resulted in increased growth attributes and straw yield in this study. However, further studies coupled with plant population or other management practices are necessary to arrive at a definite conclusion.

In this study, the increase in growth attributes such as plant height in the narrow spaces might be through high photosynthesis of taller plants.

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