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# Effect of row spacing on the growth and yield of peanut (*Arachis hypogaea* L.) stands

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## Abstract

An experiment was conducted at the Crop Botany Field Laboratory of Bangladesh Agricultural University, Mymensingh, during the period extended from November 2010 to April 2011 to study the effect of row spacing on the growth and yield of peanut (*Arachis hypogaea*). The experiment comprised five row spacings viz. 15, 20, 25, 30 and 35 cm which was laid out in a Randomized Complete Block Design with three replications. Plant to plant distance in a row for all the row spacing treatment was maintained as 15 cm. Result showed that row spacing had significant effect on growth and yield contributing characters such as plant height, number of branches/plant, leaf area index, dry matter accumulation, pod/plant, 1000-seed weight, pod or seed yield, biological yield and harvest index. It is evident that crop stature increased due to the closing of row spacing from 35 to 15 cm but the number of branches/plant has been decreased. Crops grown with wider row produced larger number of pod/plant, heavier seed and higher harvest index. Wider row spacing (i.e. 35 cm) although facilitated to accumulate larger dry matter/plant, however greater accumulation of biomass per unit of land was occurred at 20 cm inter row distance. Crop grown with 20 cm row spacing produced the highest seed yield (2.01 t/ha) and pod yield (2.82 t/ha), and thereafter the yield decreased gradually with widening the row spacing.

## Keywords

Growth, Management, Peanut, Row Spacing, Yield

## 1. Introduction

Yield of any crop is a complex phenomenon, a function of genetic factor as influenced by climate and management. The crop must be given proper management so that better growth can take place. Of the management practices, spacing is the most important one for determining yield. It is important to accommodate the most appropriate number of plants per unit area of land to obtain better yield. Proper spacing in line sowing is to be recommended to maintain required number of plant population and to undertake intercultural operations for harvesting a better yield. Improper spacing and plant density affect the normal physiological activities of the crop. In densely populated crop, the inter-specific competition between the plants is high. Again, wider spacing leads to lower yield resulted from uneconomic utilization of space. There are two general concepts to describe the relationship between plant density and seed yield. Firstly, irrespective of plant spacing within and among rows, plant density must be such that the crop develops a canopy able to intercept more than 95% of the incoming solar radiation during early reproductive growth, and so maximize seed yield (Johnson *et al*., 1982). Secondly, a nearly equidistant plant arrangement minimizes interplant competition and produces maximum seed yield (Wells, 1993).

Among the various factors that influence the yield of peanut, plantation with proper row spacing is very important. Planting density is one of the main factors that plays an important role on growth, yield and quality of peanut too. Nimje (1996) reported that accumulation of plant dry matter and branch formation were found to be greater and yield attributes like pod/plant, yield/plant and 1000-grain weight were the highest when the crop is grown with proper spacing. 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 air spaces (Miah *et al.*, 1990). A large number of research works were conducted throughout the world in order to augment the production of peanut. It was found that there is a proper spacing for planting of peanut beyond which the crop can not produce better yield. Proper attention should therefore be given on underlying concept as peanut has wider scopes for its cultivation in Bangladesh. Research reports on response of row spacing on peanut crop are scarce in Bangladesh. Therefore, the experiment was undertaken with a view to study the effect of row to row distance on the growth and yield of peanut.

## 2. Materials and Methods

*Experimental site:* An experiment was conducted in the Crop Botany Filed Laboratory, Bangladesh Agricultural University, Mymensingh during the season extended from November 2010 to April 2011. Geographically the site is located at 24°25″N latitude and 90°50″E longitude at the elevation of 18 m above the sea level. There was a moderate cool temperature during the month from November to February and high air temperature during the rest of the year. The average air temperature during the experimental period was 19 to 35°C. The average relative humidity was 74 to 88 percent and the total sunshine ranged between 143 to 266 hours/month from November to April. The experimental field was medium high land belonging to the Sonatola soil series of Grey Flood plain soil under the Agro-Ecological Zone-9 of Old Brahmaputra flood plain. The soil is silt loam with imperfectly to poorly drained permeability. The soil pH was 6.6.

*Land preparation and fertilization:* The experimental field was first opened by a tractor drawn disc plough on 28 October 2011 and two ploughings were done. After five days the land was further ploughed with a power tiller followed by laddering to get a good tilth. Weeds and stubbles were removed from the field prior to planting of seed. Recommended doses of fertilizers and manure like urea, triple super phosphate, muriate of potash, gypsum and rotten cow dung @ 50, 150, 150, 100 and 1000 kg $ha^{-1}$, respectively were mixed to soil during find land preparation. Fifty percent amount of total urea and full dose of all other fertilizers and manure were applied at the time of final land preparation. The remaining amount of urea was top dressed on 30 days after sowing (DAS).

*Experimental treatment, design and crop culture:* The experiment comprised five row distance treatments as row to row spacing 15, 20, 25, 30 and 35 cm. The plant to plant distance in a row for all the row spacing treatments was 15 cm. The experiment was conducted with a Randomized Complete Block Design with 3 replications. The unit plot size was 3m×2.5m. Distance between plot to plot was 50 cm. The peanut variety Binachinabadam-3 was used as plant material. The seeds were sown in line manually by hand on 10 November 2010. Three seeds were sown in a place and after seedling emergence one healthy plantlet was kept for continuation of crop growth. The experimental field was regularly visited to see whether the crop was damaged by insects and diseases. However, there was no pest infestation during the growing period of the crop. Weeding was done as and when necessary.

*Data collection and analysis:* Data on growth parameters like plant height, branch number/plant, leaf area index, dry matter accumulation etc were recorded from 40 DAS till final harvest with 20 days interval from destructive sampling @ 5 plants/plot. For getting the data on yield and yield components matured plants from 1 $m^2$ area from each plot were harvested. The collected data on different parameters were statistically analyzed to obtain the level of significance using MSTAT-C Package Programme. The mean differences were compared with Duncan's Multiple Range Test.

## 3. Results and Discussion

*Plant stature:* Initially the crop stature for all row spacing treatments was found shorter about 8-10 cm on 40 DAS (Figure 1). Thereafter, the stature sharply increased as the growth progressed till to maturity of the crops. It was evident that the row spacing exerted 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. The result is in agreement with that of Jyothi *et al.* (2004) and Hossain *et al.* (2005) who observed that peanut's plant height was significantly increased with higher plant densities. Sumadi et al. (1989) also found the similar result in soybean crop.

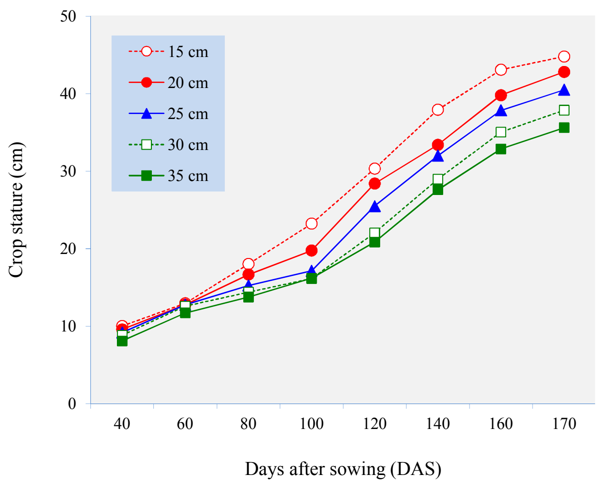


***Figure 1.*** *Crop stature of peanut canopy with time as influenced by row spacing. Mean values within a date are differed significantly (P<0.01).*

*Number of branch/plant:* Initial fewer number of branch/plant e.g. 4-6 on 40 DAS for all the row spacing treatments sharply increased as the growth progressed till to 160 DAS (Figure 2). The row spacing played significant role on the branch formation at almost all harvest dates except 40 DAS. The maximum number of branch/plant was found from the widest row spacing (i.e. 35 cm) as compared to closer row as in the order of 35>30>25>20>15 cm throughout the growing season. Hossain *et al.* (2005) found that branch number per groundnut plant was greater in wider rows as compared to closer one which commensurate the present result. Nijafi *et al*. (1997) and Gupta (1998) also found the similar type of findings in mustard.

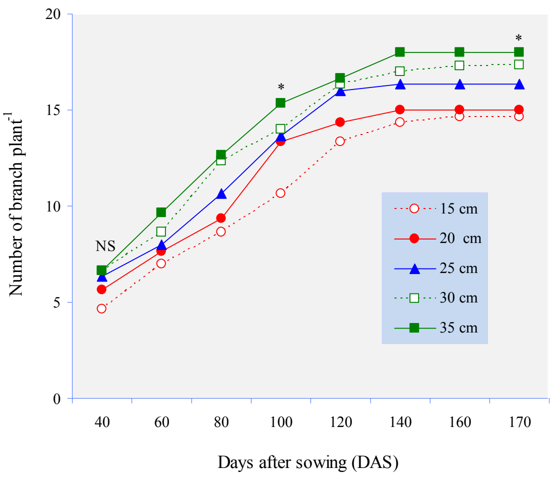


***Figure 2.*** *Number of branch per peanut plant with time as influenced by row spacing. Mean values within a date are differed significantly (P<0.01; *P<0.05; NS= not significant).*

*Leaf area index (LAI):* Initial smaller LAIs for all the treatments sharply increased as growth progressed to attain a peak on 120 DAS corresponding to maximum vegetative growth (Figure 3). From 140 DAS onward, LAIs started to decrease due to leaf senescence. The spacing has significant effect on LAI. The maximum LAI was found from the 25 cm row spacing as compared to other spacing at 120 DAS. Jyothi *et al.* (2004) found that LAI was found to be highest with 30 cm×5 cm spacing as compared to 30 cm×10 cm and 30 cm×15 cm in groundnut which support our results. Similar findings have been obtained by Tavora *et al.* (2002) and Brar *et at.* (2004) in peanut, and Krishnamurthy *et al*. (1994) in cotton.

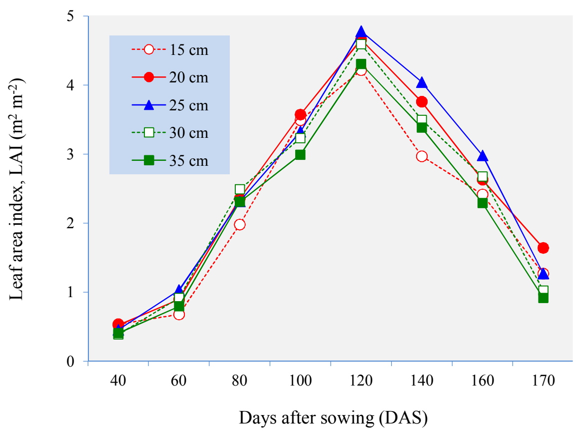


***Figure 3.*** *Leaf area index (LAI) of growing peanut crop canopy with time as influenced by row spacing. Mean values within a date are differed significantly (P<0.01).*

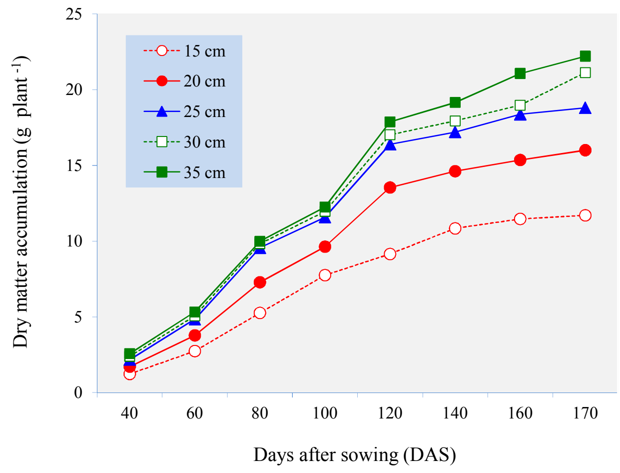


***Figure 4.*** *Dry matter accumulation per peanut plant with time as influenced by row spacing. Mean values within a date are differed significantly (P<0.01).*

*Dry matter accumulation per plant:* Initial smaller dry matter per plant like about 2-3 g/plant on 40 DAS sharply increased with time elapsed till to maturity of the crops (Figure 4). The maximum dry matter accumulation was found from the crop grown with wider row spacing (i.e. 35 cm) as compared to closer one as in the order of 35>30>25>20>15 cm throughout the growing season. Rahman and Miah (1995) reported that the lowest population density results the highest total dry matter/plant in mungbean.

*Total dry matter (TDM) accumulation per unit land:* TMD accumulation in all the row spacing crops sharply increased with time till to maturity (Figure 5). At the final harvest, the maximum dry matter per unit area was found from the crops grown with 15, 20 or 25 cm row spacing. Patra *et al.* (1999) found that crop grown with 25 cm×12 cm spacing possibly accumulated more dry matter as compared to crop sown at 50 cm×6 cm in groundnut. Seiter *et al*. (2004) also found the similar result in soybean.

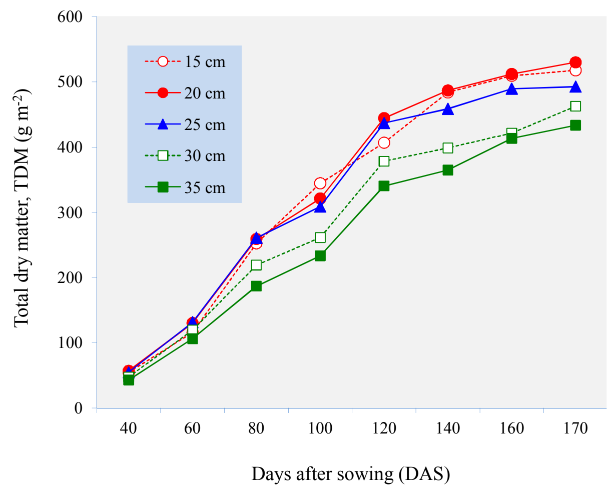


***Figure 5.*** *Total dry matter (TDM) accumulation of growing peanut canopy with time as influenced by row spacing. Mean values within a date are differed significantly (P<0.01).*

*Yield components, yield and harvest index:* The data on the number of pod/plant are shown in Table 1. Crop grown with 35 or 30 cm row spacing produced the highest number of pod/plant whereas 15 cm row spacing produced the lowest; the plants grown with other row spacings ranked intermediate. Similar results were obtained from the other yield components like pod and seed dry weight/plant, and 1000-seed weight. The management practices and microclimatic conditions were most favorable for producing the highest number of pod/plant in 35 cm row spacing might be due to less competition among the plants to get enough space for their growth and development. The results are corresponded well with the findings of Patil *et al*. (2007) who found that most yield contributing characters were found to be significantly best in the broad furrow spacing than that at closest one.

The effect of row spacing on the pod or seed yield was found significant (Table 1) where the crop grown with 20 or 25 cm row spacing produced the highest yield and lowest yield was obtained from the 15 or 35 cm row spacing. The result is supported by the findings of Patra *et al*. (1998), Yilmaz (1999), Kaushik and Chaubey (2000) who observed that peanut yield increased with decreasing the row spacing. For example Yilmaz found seed yield about 2.15 and 1.77 t/ha in groundnut from the row spacing of 25 and 50 cm, respectively.

The variability of row spacing had significant effect on biological yield (Table 1). The highest biological yield was recorded from the crop grown with 15 or 20 cm row spacing whereas the lowest biological yield was obtained from the row spacing of 30 or 35 cm. The row spacing of 25 cm ranked in middle. Islam *et al*. (1994) found that biological yield increased with closing the row space. The closer spacing of 20 cm×15 cm produced 44 percent higher biological yield than 40 cm ×30 cm spacing in rice crop.

Harvest index varied significantly due to row spacing (Table 1). It is evident that the harvest index increased with increasing the row spacing from 15 to 35 cm. Siddique *et al*. (1984) and Jahan (1998) found that increased in population density generally tended that to decrease harvest index which supports our result.

***Table 1.*** *Effect of row spacing on yield components, yield and harvest index of peanut*

| Row spacing (cm) | Number of pod plant$^{-1}$ | Pod DW (g plant$^{-1}$) | Seed DW (g plant$^{-1}$) | 1000-seed wt. (g) | Pod yield (t ha$^{-1}$) | Seed yield (t ha$^{-1}$) | Biological yield (t ha$^{-1}$) | Harvest index (%) |
|---|---|---|---|---|---|---|---|---|
| 15 | 14.67 c | 5.67 d | 4.13 e | 306.67 b | 2.64 ab | 1.85 c | 5.15 a | 36.18 d |
| 20 | 18.00 bc | 8.08 c | 6.28 d | 356.67 a | 2.82 a | 2.01 a | 5.30 a | 38.27cd |
| 25 | 21.00 ab | 9.97 b | 7.52 c | 364.33 a | 2.66 ab | 2.00 a | 4.93 ab | 40.33bc |
| 30 | 22.00 a | 11.33 ab | 8.84 b | 373.33 a | 2.51 bc | 1.96 ab | 4.63 bc | 42.00ab |
| 35 | 22.00 a | 12.24 a | 10.05 a | 376.67 a | 2.33 c | 1.93 b | 4.33 c | 44.00a |
| S$\bar{x}$ | 0.172 | 0.269 | 0.289* | 0.081* | 0.083 | 0.034 | 0.085 | 0.081 |

In a column letters followed by similar letters do not differ significantly ($P$<0.01; *$P$<0.05)

## 4. Conclusion

The greater number of pod producer did not produce the higher pod or seed yield in peanut. Crop grown with 20 cm row spacing produced the highest pod and seed yield and that of the lowest yield was obtained from the crops grown with 35 and 15 cm row spacing. However, further studies coupled with cultivars, sowing dates/seasons or other management practices are necessary to arrive at a definite conclusion.

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