

Original Research Article

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Response of Potato as Influenced by Date of Sowing, Variety and Fertilizer Dose and its Influence on Succeeding Groundnut Crop

Th. Gangarani Devi* and Sunil Kumar Gunri

Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur,
Nadia, West Bengal (741252), India

*Corresponding author

ABSTRACT

An experiment was conducted at District seed farm of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal in the year 2009-11 to study the effect of date of sowing, variety and fertilizer dose on Potato - groundnut cropping sequence in New Alluvial Zone of West Bengal. Varieties viz. Kufri Pukhraj (V_1), Kufri Chandramukhi (V_2) and Kufri Jyoti (V_3) were grown in two dates of sowings (D_1 – 18th November and D_2 – 28th November in both the year 2009 and 2010) with two fertilizer doses (F_1 - 200:150:150 kg ha⁻¹ of N: P₂O₅: K₂O, F_2 -150:125:125 kg ha⁻¹ of N: P₂O₅: K₂O). For the succeeding crop groundnut, 4 levels of fertilizer (FG_1 : No fertilizer, FG_2 , 25 % of RDF, FG_3 , 50% of RDF, FG_4 , 75% of RDF) doses were tested in the residual soil of potato. The experiment was laid out in split Strip plot design. The two years pooled data of potato in respect of plant stand m⁻² at harvest, no. of tubers plant⁻¹ and tuber weight plant⁻¹ were found maximum when planting was done on November 18. But higher single tuber weight was recorded when sowing was delayed till 28th November. Date of sowing does not influenced significantly on tuber yield of various grades. “Kufri Pukhraj” recorded maximum numbers of tuber plant⁻¹, higher single tuber weight and total tuber weight plant⁻¹ and consequently the tuber yield. Application of fertilizer doses of 200:150:150 kg ha⁻¹ of N: P₂O₅: K₂O improved plant stand m⁻² at harvest, no. of tuber plant⁻¹ but they remain at par. However increased in fertilizer dose (F_2) leads to the increased in tuber weight plant⁻¹ and also the total tuber yield significantly. Among the levels of fertilizer tested in groundnut, FG_{50} which received 50 % of recommended dose of fertilizer proved to be the optimum doses of fertilizer as far as Pod yield (kg /ha), haulm yield (kg /ha) and kernel yield is concerned.

Keywords

Potato, Date of sowing, Variety, Fertilizer dose

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Introduction

Potato is one of the most important and widely cultivated crops of West Bengal. Date of sowing plays an important role in yield and yield attributes of potato. Delayed sowing

reduces growing period, hastens maturity and ultimately reduces yield. Selection of suitable potato variety which is best suited for a particular date of sowing is very important to optimize the production. Nutrient requirement of potato is quite high due to its high

productive potentiality. Since potato is exhaustive feeder of nutrient, inclusion of legumes like groundnut become indispensable to maintain soil health. Groundnut, being a leguminous crop, can enrich soil by fixing atmospheric nitrogen. However studies on groundnut as a sequence crop of potato are very scanty. Hence, the present study was undertaken to find out the suitable nutrient management option for groundnut as well as potato using promising varieties under suitable sowing dates.

Materials and Methods

The field experiment was conducted at the District seed farm, 'AB' block at Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during rabi season of 2009 and 2010. The farm is situated at 23.5° N latitude and 89.0° E longitude with an average altitude of 9.75 meters above mean sea level. The experiment of the first crop was laid out in split plot design. The treatment consisted of two date of sowing (D₁-18th November and D₂-28th November in both the year), three varieties (V₁- Kufri Pukhraj, V₂- Kufri Chandramukhi, V₃- Kufri Jyoti) and two fertilizer doses (F₁-200:150:150 kg ha⁻¹ of N: P₂O₅: K₂O, F₂-150:125:125 kg ha⁻¹ of N: P₂O₅: K₂O). Each treatment was replicated thrice. The fertilizer was applied according to the treatment dose and schedule. Full dose of P₂O₅ and K₂O and half amount of N were applied as basal. The rest half of the N was top dressed at 30 days after planting. The variety Kufri Pukhraj was harvested 82 days after planting, Kufri Chandramukhi 106 days after planting and Kufri Jyoti 110 days after planting. For the succeeding crop groundnut, 4 levels of fertilizer (FG₁: No fertilizer, FG₂: 25 % of RDF, FG₃: 50% of RDF, FG₄ and 75% of RDF) doses were tested in the residual soil of potato. Treatments of potato which received two fertilizer doses were again subdivided into four sub plots. In each sub-plot treatment, four levels of fertilizers were tried for groundnut as

a succeeding crop. The experiment was laid out in split-strip plot design with three replications. FYM @ 5 t ha⁻¹ was applied before planting.

Results and Discussion

Effect on potato

Plant stand m⁻²

Plant stand m⁻² was not affected significantly with varied date of sowing, variety and also at varied levels of fertilizer. However, maximum (9.00) plant stand metre⁻² was observed at 18th November sowing. In case of variety, Kufri Jyoti shows maximum (9.10) plant stand metre⁻². Fertilizer dose of 200:150:150 kg ha⁻¹ of N: P₂O₅: K₂O shows maximum (8.90) plant stand metre⁻² (Table 1).

No. of tuber plant⁻¹

No. of tubers plant⁻¹ were affected significantly with varied date of sowing. It was found decreased with delaying of sowing dates. Highest no. of tuber plant⁻¹ was observed at 18th November sowing (5.23) while least was observed at 28th November sowing (4.43) (Table 2). Similar observation was also reported by Sasani *et al.*, 1981. Maximum number of tuber plant⁻¹ (5.47) was recorded in Kufri Pukhraj followed by Kufri Jyoti (4.55). Least value of 4.47 was recorded with Kufri Chandramukhi. Significant variation in number of tuber plant⁻¹ was not observed with varied levels of fertilizers. However, maximum no. of tuber plant⁻¹ (5.08) was registered when fertilizer was applied at the dose of 200:150:150 kg ha⁻¹ of N: P₂O₅: K₂O.

Single tuber weight

Single tuber weight was not affected significantly with varied date of sowing. Sowing on 28th November (52.14 g) produced

highest single tuber weight. Kufri Pukhraj (54.55 g) yields maximum single tuber weight however it remains statistically at par with Kufri Chandramukhi (54.14 g). Single tuber weight did not vary significantly with varied levels of fertilizers.

Tuber weight (g) plant⁻¹

Tuber weight plant⁻¹ were recorded highest when planting was done on 18th November (270.79 g) than when planted on 28th November (230.98 g) and they varied significantly. Among varietal treatments, Kufri Pukhraj (54.55 g) showed maximum tuber weight plant⁻¹. In case of fertilizer doses, tuber weight plant⁻¹ was reported higher when fertilizer was applied at the rate of 200:150:150 kg ha⁻¹ of N: P₂O₅: K₂O (263.30 g) than when applied with 150:125:125 N: P₂O₅: K₂O (238.84 g). The highest tuber weight plant⁻¹ (327.42 g) were found in the treatment combination of 18th November sowing with Kufri Pukhraj under 200:150:150 kg ha⁻¹ of N: P₂O₅: K₂O dose of fertilizer.

Tuber yield (t ha⁻¹)

Tuber yield of all grades and also the total yield did not show much difference with varied date of sowing. All of them remain at par in both the date of sowing. Tuber yield of both small and medium size were not significant in case of variety. However, for large size grade maximum yield of 5.47 t ha⁻¹ was recorded in Kufri Pukhraj followed by Kufri Jyoti (3.05 t ha⁻¹) and Kufri Chandramukhi (2.59 t ha⁻¹). Maximum total yield was obtained in Kufri Pukhraj (29.80 t ha⁻¹). Similar findings have also been reported by Patel *et al.*, 2002. Kufri Chandramukhi and Kufri Jyoti remain statistically at par. Tuber yield of small and large size grade did not vary significantly due to varied level of fertilizer. However, medium size tuber yield

was significantly higher with 200:150:150 kg ha⁻¹ of N: P₂O₅: K₂O (16.14 t ha⁻¹) than with lower dose (14.25 t ha⁻¹). Consequently total tuber yield was higher significantly with higher dose of fertilizer (27.79 t ha⁻¹).

The increase might be due to the positive effect of Nitrogen on growth and development and later on partitioning towards storage organs *i.e* tuber. Lanker *et al.*, (2000) also reported the similar observation.

Available nitrogen, phosphorus, potassium (kg ha⁻¹)

Available NPK content of the soil varied significantly. Initial status of available N, P, and K of the soil was recorded before the planting and again after the harvest of the crop. A build up of soil available NPK was registered in all the treatments after harvesting. The maximum (235.11 kg ha⁻¹) available Nitrogen and Phosphorus (27.11 kg ha⁻¹) in the soil was observed with first date of sowing of the variety Kufri Pukhraj under higher fertilizer levels. However, in case of available potassium, highest content was recorded when sowing was done on 18th November using Kufri Jyoti under 200:150:150 kg ha⁻¹ of N: P₂O₅: K₂O (240.51 kg ha⁻¹) (Table 3).

Effect on groundnut

Pod yield (kg ha⁻¹)

Date of sowing and varietal treatment of preceding crop potato did not influence the pod yield of succeeding crop groundnut however fertilizer doses applied in potato produced significant effect in the succeeding crop groundnut. The highest pod yield was found in F₁ (2604 kg ha⁻¹) which was significantly superior to F₂ (2479 kg ha⁻¹) (Table 4).

Table.1 Effect of date of sowing, variety and fertilizer on plant stand/m² at harvest and yield attributing characters of potato

| Treatments | Plant stand m ⁻² at harvest | No. of tuber plant ⁻¹ | Single tuber weight (g) | Tuber weight (g) plant ⁻¹ |
|--------------------|--|----------------------------------|-------------------------|--------------------------------------|
| Date of sowing (D) | | | | |
| D ₁ | 9.00 | 5.23 | 51.72 | 270.79 |
| D ₂ | 8.60 | 4.43 | 52.14 | 230.98 |
| SEm (±) | 0.12 | 0.10 | 0.72 | 1.05 |
| CD (P=0.05) | NS | 0.61 | NS | 6.43 |
| Variety (V) | | | | |
| V ₁ | 8.70 | 5.47 | 54.55 | 296.89 |
| V ₂ | 8.90 | 4.47 | 47.11 | 209.88 |
| V ₃ | 9.10 | 4.55 | 54.14 | 245.90 |
| SEm (±) | 0.12 | 0.13 | 0.41 | 1.12 |
| CD (P=0.05) | NS | 0.42 | 1.36 | 3.64 |
| Fertilizer (F) | | | | |
| F ₁ | 8.90 | 5.08 | 51.68 | 263.30 |
| F ₂ | 8.70 | 4.57 | 52.18 | 238.48 |
| SEm (±) | 0.12 | 0.13 | 0.25 | 1.18 |
| CD (P=0.05) | NS | NS | NS | 7.20 |

*Where D₁ and D₂ represent Date of sowing, 18th November and 28th November respectively, V₁, V₂ and V₃ represent varieties, Kufri Pukhraj, Kufri Chandramukhi, Kufri Jyoti respectively and F₁ and F₂ represent 200:150:150 and 150:125:125 kg/ha of N: P₂O₅: K₂O respectively.

Table.2 Effect of date of sowing, variety and fertilizer on tuber yield (t ha⁻¹) of potato

| Treatments | Small (0 – 25 g) | Medium (26–75 g) | Large (more than 75 g) | Total yield |
|--------------------|------------------|------------------|------------------------|-------------|
| Date of sowing (D) | | | | |
| D ₁ | 2.16 | 21.51 | 3.93 | 27.60 |
| D ₂ | 2.01 | 19.67 | 3.47 | 25.15 |
| SEm (±) | 0.08 | 0.40 | 0.18 | 1.19 |
| CD (P=0.05) | NS | NS | NS | NS |
| Variety (V) | | | | |
| V ₁ | 2.14 | 22.19 | 5.47 | 29.80 |
| V ₂ | 2.24 | 20.16 | 2.59 | 24.99 |
| V ₃ | 1.91 | 19.38 | 3.05 | 24.34 |
| SEm (±) | 0.15 | 0.62 | 0.22 | 0.46 |
| CD (P=0.05) | NS | NS | 0.72 | 1.49 |
| Fertilizer (F) | | | | |
| F ₁ | 1.17 | 16.14 | 3.06 | 27.79 |
| F ₂ | 1.00 | 14.25 | 2.34 | 24.97 |
| SEm (±) | 0.07 | 0.09 | 0.23 | 0.48 |
| CD (P=0.05) | NS | 0.59 | NS | 2.89 |

*Where D₁ and D₂ represent Date of sowing, 18th November and 28th November respectively, V₁, V₂ and V₃ represent varieties, Kufri Pukhraj, Kufri Chandramukhi, Kufri Jyoti respectively and F₁ and F₂ represent 200:150:150 and 150:125:125 kg/ha of N: P₂O₅: K₂O respectively.

Table.3 Effect of date of sowing, variety and fertilizer doses on available N, P and K in soil after harvesting of potato

| Treatments | Available N (kg ha ⁻¹) | | Available P (kg ha ⁻¹) | | Available K (kg ha ⁻¹) | |
|--|------------------------------------|--------|------------------------------------|-------|------------------------------------|--------|
| | Initial | Final | Initial | Final | Initial | Final |
| D ₁ V ₁ F ₁ | 207.65 | 235.11 | 17.75 | 23.15 | 208.59 | 230.11 |
| D ₁ V ₁ F ₂ | 207.65 | 218.31 | 17.75 | 20.80 | 208.59 | 224.52 |
| D ₁ V ₂ F ₁ | 207.65 | 231.16 | 17.75 | 24.11 | 208.59 | 233.41 |
| D ₁ V ₂ F ₂ | 207.65 | 220.33 | 17.75 | 21.00 | 208.59 | 229.62 |
| D ₁ V ₃ F ₁ | 207.65 | 229.21 | 17.75 | 25.05 | 208.59 | 240.51 |
| D ₁ V ₃ F ₂ | 207.65 | 218.51 | 17.75 | 20.11 | 208.59 | 230.62 |
| D ₂ V ₁ F ₁ | 207.65 | 230.51 | 17.75 | 26.05 | 208.59 | 228.21 |
| D ₂ V ₁ F ₂ | 207.65 | 220.21 | 17.75 | 22.51 | 208.59 | 221.56 |
| D ₂ V ₂ F ₁ | 207.65 | 236.22 | 17.75 | 26.73 | 208.59 | 236.11 |
| D ₂ V ₂ F ₂ | 207.65 | 224.05 | 17.75 | 20.03 | 208.59 | 228.52 |
| D ₂ V ₃ F ₁ | 207.65 | 238.11 | 17.75 | 27.11 | 208.59 | 238.66 |
| D ₂ V ₃ F ₂ | 207.65 | 226.81 | 17.75 | 21.80 | 208.59 | 229.54 |

*Where D₁ and D₂ represent Date of sowing, 18th November and 28th November respectively, V₁, V₂ and V₃ represent varieties, Kufri Pukhraj, Kufri Chandramukhi, Kufri Jyoti respectively and F₁ and F₂ represent 200:150:150 and 150:125:125 kg/ha of N: P₂O₅: K₂O, respectively.

Table.4 Effect of treatments on pod yield (kg ha⁻¹), haulm yield (kg ha⁻¹) and kernel yield (kg ha⁻¹) of groundnut

| Treatment | Pod yield (kg ha ⁻¹) | Haulm yield (kg ha ⁻¹) | Kernel yield (kg ha ⁻¹) |
|--------------------|----------------------------------|------------------------------------|-------------------------------------|
| Date of sowing (D) | | | |
| D ₁ | 2667 | 3285 | 1900 |
| D ₂ | 2416 | 3073 | 1696 |
| SEm (±) | 53.470 | 17.000 | 12.500 |
| CD (P = 0.05) | NS | 103.443 | 76.061 |
| Variety (V) | | | |
| V ₁ | 2595 | 3216 | 1830 |
| V ₂ | 2514 | 3165 | 1794 |
| V ₃ | 2515 | 3156 | 1771 |
| SEm (±) | 41.20 | 32.90 | 27.30 |
| CD (P = 0.05) | NS | 107.29 | NS |
| Fertilizer (F) | | | |
| F ₁ | 2604 | 3233 | 1850 |
| F ₂ | 2479 | 3125 | 1747 |
| SEm (±) | 5.90 | 18.80 | 18.20 |
| CD (P = 0.05) | 35.90 | 114.39 | 110.74 |
| Fertilizer (FG) | | | |
| FG ₁ | 2367 | 2928 | 1632 |
| FG ₂ | 2632 | 3243 | 1873 |
| FG ₃ | 2683 | 3322 | 1941 |
| FG ₄ | 2486 | 3223 | 1747 |
| SEm (±) | 19.90 | 41.50 | 32.40 |
| CD (P = 0.05) | 68.86 | 143.60 | 112.11 |

*Where D₁ and D₂ represent Date of sowing, 18th November and 28th November respectively, V₁, V₂ and V₃ represent varieties, Kufri Pukhraj, Kufri Chandramukhi, Kufri Jyoti respectively, F₁ and F₂ represent 200:150:150 and 150:125:125 kg/ha of N: P₂O₅: K₂O respectively in potato and FG₁, FG₂, FG₃, and FG₄ represent No fertilizer, 25 % of RDF, 50% of RDF, 75% of RDF respectively in groundnut.

Haulm yield (kg ha⁻¹)

Date of sowing of preceding crop potato had significant influence in the haulm yield of groundnut. The highest haulm yield was recorded with the treatment D₁ (3285 kg ha⁻¹). Due to varietal treatment also haulm yield was significantly differed and the maximum haulm yield was recorded in variety V₁ (3216 kg ha⁻¹). Fertilizer treatment also produced significant effect on haulm yield and it was obtained with the treatment F₁ (3233 kg ha⁻¹)

Kernel yield (kg ha⁻¹)

Significant variation due to date of sowing of preceding crop potato was observed on kernel yield. The highest Kernel yield was recorded with the treatment D₁ (1900 kg ha⁻¹). However there is no significant effect on kernel yield of groundnut due to varietal treatment. There was also a significant effect due to fertilizer treatment. The highest kernel yield was obtained with the treatment F₁ (1850 kg ha⁻¹).

Effect due to fertilizer doses in groundnut

The fertilizer doses applied in groundnut after harvest of potato had a profound effect in increasing the groundnut yield. Among four fertilizer doses applied in groundnut the pod yield increased with the increasing levels of fertilizer. Maximum pod yield (2683 kg ha⁻¹), haulm yield (3322 kg ha⁻¹) and kernel yield (1941 kg ha⁻¹) were obtained in FG₃ treatment (50% of RDF applied in groundnut) thereafter yield decreased with further increased the fertilizer level in the treatment FG₄ (75% of RDF applied in groundnut). This might be due to the residual NPK fertilizer which was present in the soil in considerable amount. The treatment FG₃ and FG₂ (75% and 25% of RDF in groundnut) was statistically at par but

significantly differed from FG₁ (no fertilizer in groundnut) and FG₄ (75% of RDF applied in groundnut).

It can be concluded that good harvest of the potato tuber can be obtained with 18th November sowing using Kufri Pukhraj variety with a fertilizer dose of 200: 150:150 kg ha⁻¹ of N: P₂O₅ and K₂O. From this experiment it may be concluded that potato planting in right time with optimum dose of fertilizer not only produced the highest tuber yield but also a good harvest of the succeeding crop like groundnut could be achieved with reducing dose (50% of recommended dose) of fertilizer. Thus, higher profit is possible under such productive cropping sequence.

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