Effects on Plant Canopy, Tuber Yield and Growth Responses By Seed Size, Spacing and Nitrogen In Potato(Solanum Tuberosum L.)

P Kumar[1], A.K. Bhatia[2], N Brar[3], S Kumar[4], S J Singh[5], Anjan Kumar Sinha[6]
[1, 2, 3, 4, 5] Dept of Vegetable Science
[2]Dept of Botany
[1, 2, 3, 4, 5] CCS Haryana Agricultural University, Hisar- 125004, Haryana
[6]Bankura Sammilani College, Bankura-722102, West Bengal

Abstract- *The experiment comprising of three seed size (25-50g, >50-75g and >75-100g), three plant spacing (60x10, 60x15 and 60x20 cm) and two nitrogen level (100 and 125 N kg/ha)was laid out in a random block design with three replications. It was found that the cultivar Kufri Bahar produced highest total tuber yield when >50-75g seed size tubers were planted at a spacing 60x20 cm and nitrogen level 125 kg/ha which was followed by seed size >75-100g, plant spacing 60x15 cm and nitrogen level 100 kg/ha.*

Keywords- Solanum tuberosum, Growth response, seed size, plant spacing, Nitrogen level.

I. INTRODUCTION

Potato (*Solanum tuberosum* L.) belongs to family solanaceae is one of the most important food crops grown throughout India (Pradhan et al., 2014). It is a unique crop, which can supplement the food needs as food security option in India(http://nhb.gov.in). Whenever there has been a scarcity of food grains (Sherri et al., 2012), global population is projected to reach 9.1 billion by 2015 (Wani and Sah, 2014) and recent trends in climate change, potato has come to the rescue of the people (Sherri et al., 2012, Pradhan et al., 2014)with a production of 45.34 million t from 1.99 million ha with an average yield of 22.76 t/ha during 2012-13 (http://nhb.gov.in) and per capita consumption 19.78 kg/year (Singh et al., 2014).Potato is the only non-cereal food crop to command such a high position in the world, since being nutritious food it can solve the problem of malnutrition (Pradhan et al., 2014) and under-nutrition if adopted as food crop, not merely as a vegetable crop (CRDI, 2014).Presently, India is the third larger producer of potato in the world after China and Russia and the crop occupies 18.11 lakh hectares with production of 285.8 lakh tonnes (Anonymous, 2008). Being principal cash crop it contributes to the country's economy in several ways since it possessed export potential for seed and table purpose to the neighbouring and EU countries (Das, 2003, Khurana et al., 2003). Judicious fertilization, optimum planting density and appropriate seed tuber size are the most important factors in the production of potato. Among various inputs used in the production of potato, seed is the costliest one as it contributes about 40% to the total cost of cultivation (Rao, 1986). Hence size of seed tubers and appropriate spacing have a great bearing on the economy of potato crops production. Increase in size of seed tubers generally results in higher yields but it also increases the cost of production. Planting small, medium and large size tubers at appropriate spacing appear to offer immense possibilities of controlling the seed rate to an economic level and also for getting optimum yield (Singh, 1989). According to Sandhu and Kang (1962) the potato crop giving 300 q/ha tubers, removes 180kg of nitrogen, 45kg phosphoric acid and 260kg of potash. It is of paramount importance to make the best use of fertilizer, keeping in view the nutrient supplying capacity of soil to get higher yield with minimum cost (Grewal, 1986).A number of factors like availability of quality seed of good seed size, plant spacing and nitrogen levels play an important role in deciding the productivity and quality of produce. White (1980) noted that seed size, plant spacing and nitrogen were important factors in deciding the potato yield. The result and studies conducted in India and abroad indicate that seed size (Kumar *et al.*2009, Zamil et al. 2010), plant spacing (Kushwah, 2001) and nitrogen levels of cultivars has great bearing on growth and yield of potato (Zamil et al. 2010). Therefore, selection of seed size, plant spacing and nitrogen level is an important aspect in potato crops improvement programme.

II. MATERIALS AND METHOD

The experimentwas conducted at Research Farm of Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar during *rabi* season of 2009-10 with three seed size tubers (25-50,50-75 and 75-100g) with three plant spacing (60x10,60x15 and 60x20 cm) and two nitrogen levels (100kg/ha and 125 kg/ha) was used for cultivars of potato. The experiment was laid out in random

block design with the following parameters; Per cent plant emergence at 14, 18, 22, 26 and 30 DAP, Plant height (cm) at 45, 60, 75 and DAP, Number of stems per hill at 45 DAP, Number of leaves per stem, Leaves weight per hill (g), Stem weight per hill (g), Leaf area index, Weight of foliage, Number of tuber/plot in different grades (Up to 25 g, >25-50 g, >50-75 g, >75 g), Total number of tubers/plot, Total number of tubers/ha, Weight of tubers (g)/plot in different grade (kg/plot; Up to 25g, >25-50g, >50-75g, >75g), Total tuber yield (kg/plot), Total tuber yield (kg/ha).The data obtained for different parameters were statistically analysed following the analysis "f" variance techniques by using OPSTAT CCSHAU computer package programme and treatment means were compared by least Significant difference at 5% level of probability (Gomez and Gomez, 1984).

III. RESULTS

Seed size, plant spacing and nitrogen levels have significant effect on per cent plant emergence at all the stages of plant growth expect 26 and 30 days after planting. The smaller seed size tubers showed maximum plant emergence at 14, 18 and 22 days after planting as compare to larger seed size tubers. Application of 100kg N/ha showed significantly higher per cent plant emergence at different intervals as compared to the 125kg N/ha expect 30 days after planting.Plant height was recorded maximum at 75 days after planting when 75-100g tubers were planted however the differences were not found significant among various seed size at different stages.There was no significant effect of plant spacing on plant height at different stages of plant growth whereas, different nitrogen levels showed significant difference at different stage of plant growth except at 45 days after planting. Maximum plant height (64.63 and 71.77cm, respectively) was recorded at 60 and 75 days after planting with the application of 125kg nitrogen/ ha.Number of stems per hill was significantly influenced by the different treatments of seed size plant spacing and nitrogen levels. Among the different seed sizes, maximum number of stems per hill was recorded when>50-75g seed size tubers were planted .Seed size of 25-50g and >75-100g tubers showed lower number of stem per hill and both the treatments were found statistically at par with each other. At different plant spacing, number of stems per hill increases with the increase in spacing.Nitrogen level at 125kg/ha produced significantly more number of stems per hill (4.63) as compare to other treatments.More number of leaves per stem was recorded when >75-100g tubers were planting at plant spacing, 60x20 cm with the application 125kg nitrogen/ha. However no significant variation among the various treatments was observed.Leaves weight per hill was significant influenced by the different size of seedling tubers. Maximum leaf weight per hill was recorded when >50-75g seed size tubers were used for planting which was followed by >75-100g tuber size.Minimum size of tubers (25-50g) when planted produced lowest leaves weight per hill. Among the plant spacing, 60x20 cm exhibited highest leaves weight per hill while closer spacing of 60x10 cm showed significantly minimum leaf weight per hill. The higher dose of nitrogen produced significantly higher leaf weight per hill (179.05kg/ha) than the lower dose of nitrogen.The highest stem weight per hill was recorded when >50-75g seed size tubers were planted followed by 75-100g seed size tubers. The maximum stem weight per hill was recorded at a plant spacing of 60x20 cm. The stem weight per hill increased with increasing level of nitrogen and maximum at 125kg/ha while nitrogen at 100kg/ha produced lower stem weight per hill. Seed size, >50-75g tuber produced maximum weight of foliage which was followed by >75-100g. Plant spacing also showed the significant effect on weight of foliage and 60x20 cm produced maximum weight of foliage per hill followed by 60x15 cm. Nitrogen level 125kg/ha significantly produced highest weight of foliage per hill as compared to 100kg nitrogen per hectare.Seed size of >75-100g tubers significantly produced maximum number of 25g, >25-50g and >50-75g tubers per plot. There was significant increased in number of tubers of different grades except of >75g grade tubers with the increase in seed size tubers planted for raising the potato crop. Smaller size of tubers produced significantly minimum number of tubers of different grades. The plant spacing, 60x10 cm produced maximum number of tubers up to 25g grade and >25-50g grade tubers while plant spacing of 60 x 20 cm produced maximum number of tubers per plot of >50-75g grade and >75-100g grade. Nitrogen level @ 125kg/ha exhibited significantly maximum number of tubers per plot up to 25g grade and >50-75g and >75-100g grade, however, application of nitrogen at lower dose (100kg/ha) showed the maximum number of tubers of >25-50g grade. The total number of tubers / plot and tubers/ ha was significantly influenced by the different treatment of seed size, plant spacing and nitrogen level. The maximum total number of tubers per plot were recorded when seed size of >75-100 were used for planting followed by the seed size of >50-75g tuber (628.38). The crop planted at a plant spacing of 60x20 cm showed the highest total number of tubers per plot (703.61) followed by 60x15 cm plant spacing. Nitrogen level 125 kg/ha produced significantly maximum number of tubers as compared to 100 kg/ha.The weight of tubers of >75g grade was recorded maximum when >50-75g seed size was used followed by >75-100g seed size and both the treatments were found significantly superior to each other. There was markedly increased in weight of tubers of >25-50 and >50-75g grades with the increase in seed size tubers. Tuber weight increased

with the increase in plant spacing and maximum was found at 60x20 cm. Nitrogen level also differed significantly and observed maximum in 125 kg/ha. The weight of tubers of different grades of potato enhances considerable with the increase in seed size, plant spacing and nitrogen levels.The total tuber yield per plot was recorded highest when >50-75g seed size tubers were planted which was closely followed by >75-100g tuber size. The plant spacing of 60x20 cm had shown significantly highest tuber yield per plot as compared to 60x10 cm and 60x15 cm plant spacing. The total tuber yield per plot increased significantly with increase level of plant spacing and nitrogen.The results of the present study agreed with Khurana and Pandita (1982), Kumar *et al.* (1991), Chaurasia and Singh (1993), Chodhary *et al.* (2002), Malik *et al*. (2002), Singh and Raghar (2002), Nizamuddin *et al.* (2003), Nandekar (2005), Khurana and Bhatia (2008), Kumar *et al.* (2009), Khan *et al*. (2010), Zamil *et al.* (2010).

IV. CONCLUSION

It may be concluded that the per cent plant emergence, plant height, leaves/stem, leaf area index, number of tubers up to 25g, >25-50g and >50-75g grade, total number of tuber, weight of tuber >25-50g and >50-75g grade were statistically higher with seed size >75-100g tubers. However, the value for number of stems per hill, leaves weight per hill, stem weight and weight of foliage, number of tubers per plot >75 g grade, weight of tubers up to 25 and >75g and total tuber yield was maximum with >50-75g seed size tubers. Different plant spacing exhibited significant difference growth and yield parameters. The maximum value for plant height, stem/hill, leaves/stem, leaf area index , leaves weight, stem weight, weight of foliage, number of tubers >50-75g and >75g grade, total number of tubers, weight of tubers up to 25g, >25-50g >50-75g and >75g grade, total tuber yield, were maximum with 60x20cm plant spacing. However, per cent plant emergence was found maximum with plant spacing 60x15 cm and number of tubers per plot with up to 25g and >25-50g grade tubers found maximum with plant spacing 60x10 cm. Effect of nitrogen level showed remarkable variation for growth and yield parameters except per cent plant emergence. Significantly highest value was registered for plant height, stem/hill, leaves/stem, leaf area index, leaves weight, stem weight, weight of foliage, number of tubers up to 25g, >25-50g >50-75g and >75g, total number of tubers, weight of tubers up to 25g, >25-50g >50-75g and >75g grade, total tuber yield, with nitrogen 125 kg/ha. However, plant emergence found maximum with 100kg nitrogen/ha.Kufri Bahar produced highest total tuber yield when >50-75g seed size tubers were planted at a spacing 60 x 20 cm and nitrogen level 125 kg/ha which was followed by seed size >75-100g, plant spacing 60 x 15 cm and nitrogen level 100 kg/ha.

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