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RESPONSE OF SPLIT APPLICATION OF NITROGEN FERTILIZER ON YIELD OF POTATO CROP (*SOLANUM TUBEROSUM* L.)

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ABSTRACT

A field experiment was conducted to observe nitrogen efficacy for split application to potato crop. Urea (N 46%) was applied @ 250 kg per hectare in split doses to potato cultivar named PARS-70. Data regarding various growth and yield characteristics like germination, number of stems/ plant, plant height, number of compound leaves per plant, number of tuber per plant, mortality percentage, weight of tubers per plant (g), and per plot (kg), tuber yield per acre (tons) and per hectare (Tons), total Biomass per plant (g), foliage fresh weight per plant (g), foliage dry weight per plant (g), tuber dry weight per plant (g) were recorded and analyzed statistically following standard procedure at 5% probability level. T_6 which received the total amount of Nitrogen in 5 splited applications produced best results regarding all the studying parameters while T_1, received only basil dose of Nitrogen, produced minimum of all the above parameters.

Key Word: Nitrogen, Split Application, Potato, *Solanum tuberosum* L., Fertilization, Growth and yield

INTRODUCTION

Potato (*Solanum tuberosum* L) occupies a prominent position among different farm and vegetable crops in Pakistan being a food as well as a cash crop. Potato contributes considerably to the dietary requirements of increasing population of the world. It provides 19.4% carbohydrates and 2% protein with 77.5% water. It also provides a wide range of commercial products such as alcohol, dextrose glucose and lactic acid. Apart from this, minerals and vitamin "C", essential for human health and vigor, are also found (Talbur *et al*., 1975). In order to increase the yield of potato crop, one has to keep several factors in view. Proper fertilization can play an important role to improve the yield of this crop.

Poor health of the plant directly reduces the tuber yield of the potato. Various nutrients such as nitrogen, phosphorous and potassium play an essential role for this purpose. These nutrients should be provided to potato crop in balance proportion. Nitrogen is a major and essential plant nutrient for most of the crops. It enhances the vegetative growth. Time of application of nitrogen is very important, because if nitrogen is applied in whole quantity at early growth stage, then its wastage is more pronounced and it does number become available to the crop at the later growth stages. An adequate splited supply of nitrogen is associated with normal plant growth to maintain production at higher level. Nitrogen fertilizers are applied at different plant growth stages with split applications. It is an admitted fact that yields of potato is enhanced with appropriate split application of nitrogen.

In the present study nitrogen fertilizer was applied with split applications to investigate their efficacy on potato cultivar PARS-70 for further recommendations for farming community.

Porter and Sission (1989) studied the yield and market quality of potatoes in response of side dressed nitrogen. Potatoes were given 80 and 90 kg nitrogen per ha. at planting followed by an additional 90 kg side dressed after tuber initiation and 90 kg/ha at planting followed by an additional 45 kg/ha side dressed. Split application of nitrogen increased the tuber yield of potatoes.

Payton (1990) conducted an experiment to determine the effect of nitrogen fertilizer on the growth and development of the potato crop. He applied N at the rate of 0, 60, 120, 180 and 240 kg/ ha, applied all at planting or split 50% at planting 50% at earthing up). Split N application increased the tuber yield, tuber dry weight, tuber fresh weight and totals biomass production of potato crop. Robricht (1991) studied the effectiveness of split N application in potato crop. He applied N at the rates of 75, 100, 125, or 150 kg/ha either one application at emergence or 70% at emergence and remaining 30% at the 4 leaf stage. Split N fertilizer application increased yield by 21.8 t/ha. Stark *et al*., (1993) reported that potato cultivar Russet Burbank when given a total of 132 kg Nitrogen per hectare (N/ha) applied through the irrigation system six weekly application of 22 kg N/ha and 3, biweekly application of 44 kg N/ha, results showed that biweekly N application produced higher yield then weekly N application. Rehman *et al*., (1993) studied the effect of various nitrogenous fertilizers applied at different times on the yield of autumn potatoes. They reported that split application of nitrogen was found better then its total application at the time of sowing. Moreover, the split application with 50 days interval after sowing was more beneficial than applied after 30

days. Janggoo *et al*., (1996) splitted nitrogen at the rate of 0,2,4 and 8 g per liter 30 days after planting. Plant height was increased with 2 applications of Nitrogen. Number of tuber and tuber fresh weight per plant were increased with N application at later growth stages of potato. Waddell *et al*., (1999) performed an experiment to study the different sources of N on growth and yield of potato. They concluded that urea (46% N) produced the maximum tuber yield when applied 1/3 at planting, 1/3 at first irrigation and 1/3 at second irrigation. Oliveira (2000) applied N as first and second side dressings at the rates of 40-0-0, 40-60-40, 40-160-0 and 40-80-30 kg/ha. The rate of leaf appearance increased under high N treatment at different growth stages, above ground dry matter per plant was increased. Kiddin and Zamaraev (1996) applied Nitrogen at different times, i.e.; before planting potatoes, at sprouting, at but stage and at flowering. The effectiveness of n fertilizer depends on the time of application. The maximum yield was obtained with N application at sprouting, or with N application at sprouting and at budding.

MATERIALS AND METHODS

Experiment was laid out at Vegetable Research Area, University of Agriculture, Faisalabad, Pakistan during 2001-2002. according to RCBD with four replications. Tubers of potato cultivar named PARS-70 and fertilizer Urea (46%N) were included in the experiment. Urea was applied as a source of nitrogen @ 250kg/hac.in split doses. First split dose was applied after 25 days of planting and remaining was applied after one-week intervals. Treatments were followed as: T1= no split dose (only one basal dose); T2= 1 split dose (1/2 at sowing, 1/2 after 25 days); T3= 2 split doses (1/3 at sowing, 1/3 after 25 days, 1/3 after 33 days); T4= 3 split doses (1/4 at sowing, 1/4 after 25 days, 1/4 after 33 days, 1/4 after 41 days); T5= 4 split doses (1/5 at sowing, 1/5 after 25 days, 1/5 after 33 days, 1/5 after 41 days, 1/5 after 49 days); T6= 5 split doses (1/6 at sowing, 1/6 after 25 days, 1/6 after 33 days, 1/6 after 41 days, 1/6 after 49 days, 1/6 after 57 days). Tubers were sown on 27th September; both years on ridges, which were kept 2.5 feet apart, and plant-to-plant distance maintained was 6 inches. The other cultural practices were kept same. Data collected were analyzed statistically by using Fisher's analysis of variance and treatment means were compared by using DMR test at 5% probability level (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Data on germination percentage shown number of significant differences among the various treatment means. However, maximum germination percentage was observed in case of T_2 and minimum germination percentage was recorded in the case of T_3. Mortality was maximum in the case of T_3 and minimum in T_2. Data on number of stems per plant revealed significant differences. However, stem number was maximum in T_6 and minimum in T_1 (control). Observations recorded on number of compound leaves per plant indicated that T_6 produced maximum number of compound leaves per plant while T_1 (control) gave minimum number of compound leaves per plant.

Table 1. Effect of split nitrogen application on growth and yield of potato crop.

Treatments → / Parameters ↓	T1	T2	T3	T4	T5	T6
Germination %age	68.74	72.65	67.08	70.31	68.75	67.19
Mortality %age	31.16	27.35	32.82	29.60	31.25	32.73
No. of stem /plant	3.50	3.90	4.10	3.50	3.95	4.25
Compound leaves/plant	48.65	68.30	68.50	77.05	87.80	97.25
Height of plant (cm.)	27.50	32.55	30.70	30.35	32.95	35.30
No. of tuber/plant	7.52	8.98	10.51	10.01	9.53	10.08
Wt.of tuber/plant (g)	278.6	339.1	391.5	397.4	471.7	562.1
Wt.of tuber /plot (Kg)	12.30	15.83	16.81	18.09	20.76	24.11
Yield of tuber /acre (tons)	5.682	7.315	7.765	8.365	9.592	11.14
Yield of tuber/hac (tons)	14.22	18.30	19.42	20.92	23.99	27.87
Total Biomass/plant (g)	364.9	436.7	502.7	519.9	615.7	698.3
Foliage fresh Wt./plant (g)	86.26	97.61	111.2	122.6	133.9	136.2
Foliage dry Wt./plant (g)	21.91	19.03	22.58	27.77	31.74	30.64
Tuber dry Wt./plant (g)	57.18	67.85	80.77	82.35	95.45	116.1

T1= no split dose (only one basal dose); T2= 1 split dose (1/2 at sowing, 1/2 after 25 days.); T3= 2 split doses (1/3 at sowing, 1/3 after 25 days, 1/3 after 33 days.); T4= 3 split doses (1/4 at sowing, 1/4 after 25 days, 1/4 after 33 days, 1/4 after 41 days.); T5= 4 split doses (1/5 at sowing, 1/5 after 25 days, 1/5 after 33 days, 1/5 after 41 days, 1/5 after 49 days.); T6= 5 split doses (1/6 at sowing, 1/6 after 25 days, 1/6 after 33 days, 1/6 after 41 days, 1/6 after 49 days, 1/6 after 57

Information received on height of plant revealed that T_6 produced maximum plant height and T_1 (control) showed minimum plant height. Number of tuber per plant was maximum in T_6 and minimum in T_1 (control). Data on weight of tuber per plant showed that T_6 occupies the highest position and dominated over rest of the treatments while T_1 (control) occupies the lowest position. Weight of tuber per plot was maximum in T_6 and minimum in T_1 (control). T_6 produced maximum tuber yield per acre while, minimum tuber yield per acre was given by T_1 (control). Observations recorded on tuber yield per hectare showed significant differences. Maximum tuber yield per hectare was produced by T_6 while; minimum tuber yield per hectare was produced by T_1. Total biomass per plant was maximum in T_6 while minimum in case of T_1 (control). Analysis for variance for foliage fresh weight per plant showed maximum production by T_6 and minimum by T_1 (control). Foliage dry weight per plant was maximum in T_6 while minimum in case of T_1 (control). Maximum tuber dry weight per plant was observed from T_6 while, minimum from T_1 (control).

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