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The Effect of Seed Tuber Size, Inter-Row Spacing and Ridging Frequency on the Yield of Potato (*Solanum tuberosum* L.)

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Abstract

The use of inappropriate agronomic package is one of the many factors contributing to the low yield of potato in Ethiopia. The optimum level of any one of agronomic practices varies with environment, purpose of the crop, cultivar and expected economic advantage. To this end a trial comprising different sizes of seed tuber, interrow spacing and frequency of ridgings was carried out at Adet Research Center for two consecutive years (1993-1994) with the main objective of determining the optimum seed rate, stem density and ridging frequency for ware and seed tuber potato production. The trial was laid out in 3^3 partially confounded design of two replications. The results reveal that marketable and total tuber yield, stem number/plant and number of tubers of different size grades were significantly ($P < 0.01$) influenced by seed tuber size and interrow spacing. Generally, as seed tuber size increased stem number/plant, optimum seed tuber size and ware potato, and marketable and total tuber yield seemed to increase. The narrower the spacing between rows, however, increased the stem density and seed tuber size grades. There were no significant differences among the tested ridging frequency levels. In conclusion, a stem density of $21/m^2$ (55,555 population), seed size grade of 45-55 mm diameter at a spacing of 60 cm (28 q/ha seed rate) for seed potato production, and $16/m^2$ (44,444 population), seed size grade of 45-55 mm diameter at a spacing of 75 cm (22 q/ha seed rate) for ware potato production together with ridging once in 3-4 weeks after crop emergence was found to be the optimum for high yields of potato production. Total and marketable tuber yields obtained at these rates were 283 and 226 q/ha which are by far higher than other levels tested.

Introduction

The very low yield of potatoes per unit area in Ethiopia is attributed to the use of poor agronomic practices by farmers. To optimize potato productivity a full package of information is needed (4). Use of optimum stem density in a potato crop avoids competition among growing plants for growth factors as well yield loss due to improper spacing used besides creating a conducive

condition to facilitate other cultural practices. Research works undertaken in different area revealed that the optimum stem density of a potato crop depends on the environment, purpose of the crop, and potato variety.

In Holland, at least 30 main stems/m^2 for seed tuber production and 20-25 main stems for ware tuber production are recommended. Research results in Kenya indicated that 25 main stem/m^2 for cultivar B53 and Reslin Gucha and 30 main stems for the cultivars Baraka and Anett are required for the production of seed size tubers. Similarly, trial conducted on ridging frequency at Alemaya showed that a yield loss as high as 8% is sacrificed due to poor ridging as a result of tuber exposure to direct sun light, high temperature, disease and insect damage (1).

To date no recommendation of this sort has been made in the Adet region. Therefore, this trial was conducted with the objectives of determining the optimum seed tuber size and inter-row spacing thereby optimize stem density for ware and seed tuber production as well optimum ridging.

Materials and Methods

An experiment on the influence of seed tuber size, inter-row spacing and ridging frequency on potato yield was conducted for two consecutive years 1993/1994 at Adet. The objective of the experiment is to determine optimum seed size and inter row spacing for optimum stem density of ware and seed tuber production and optimum ridging frequency to avoid yield loss due to improper ridging. The experiment was laidout in partially confounded design of 3^3. The factors used were 3 levels of seed tuber sizes of 25-35 mm (25 g), 35-45 mm (50 g) and 45-55 mm (90 g), and 3 levels of interrow spacing, i.e., 45 cm, 6o cm and 75 cm and 3 levels of ridging frequency, i.e., ridging one time 3 weeks ridging twice at 3rd and 6th weeks and ridging trice at the 3rd, 6th and 9th weeks after crop emergence, respectively.

The plot size used was $27m^2$ (9m x 3m) having different rows per plot and different interrow spacing with 30 cm interrow spacing used for all treatments. The variety used in the trial was "Sissay". The crop was harvested after about four months at maturity and data were taken from randomly selected rows of 10 m length. A combined analysis of variance was computed for total tuber yield, marketable tuber yield, different grade sizes of tubers number and stem number/m^2.

Results and Discussion

Total tuber yield, tuber size grade of 30-40m, 40-50 and stem number /m^2 was highly and significantly ($P<0.01$) influenced by year (Table 1). The first year was better than the second year in all the above considered parameters. And this might be attributed to the variations over years in environmental conditions such as temperature and rainfall. Seed tuber size significantly ($P<0.01$) affected total and marketable tuber yields, tuber size grades of > 50 mm diameter and stem number/m^2 (Table 1). Maximum total and marketable tuber yield was obtained from seed size grade 45-55 mm. Maximum number of > 50 mm size grade tubers, however, was obtained from seed size of 25-35 mm diameter which resulted from a 6 g weight difference obtained from using 45-55 mm seed size grade. Still more number of stems/m^2 was from of 45-55 mm size.

Table 1. ANOVA of total and marketable tuber yield, stem No./m^2, different tuber size grades

	Total tuber yield q/ha	Market. tuber yield q/ha	20-30 mm size grade	30-40 mm size grade	40-50 mm size grade	>50 mm size grade	stem number per m2
Year	P<0.01	N.S.	N.S.	P<0.01	P<0.01	N.S.	P<0.01
Seed tuber Size (S.S)	P<0.01	P<0.01	N.S.	N.S.	N.S.	P<0.01	P<0.01
Interrow spacing (I.S.)	N.S.	N.S.	N.S.	P<0.05	P<0.01	P<0.05	P<0.01
Ridging Frequency (R.F.)	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
S.S x I.S	NS	NS	NS	NS	NS	NS	P<0.01
I.S x R.F	NS	NS	NS	NS	NS	NS	NS
C.V %	12	17					

Inter-row spacing significantly influenced tuber size grades of 40-50 mm number of stems/m^2, >50 mm and 30-40 mm tuber size grades (Table 1).

Maximum number of 40-50 mm tuber sizes were produced from 45 cm spacing with a variation of 1.25 and 1.60 number from the 60 cm and 75 cm spacings tested, respectively. Still more number of stems/m^2 was obtained from 45 cm spacing. However, more number of tuber size grades of 30-40 mm and >50 mm were from 60 cm and 75 cm spacings, respectively. Ridging levels did not significantly influence either of the parameters considered. Non significant was also the interaction between interrow spacing and ridging levels. Stem number/m^2 was significantly influenced (P<0.01) by the interaction of seed tuber size and interrow spacing (Table 1). And the maximum number was from 54-55 mm seed size planted at 45 cm spacing.

In conclusion, looking into seed rate, output produce and feasibility for other cultural practices, seed size grade of 45-55 mm diameter at a spacing of 60 cm (28q/ha seed rate) ridged once 3-4 weeks after crop emergence for seed potato production, i.e., 21 stems/m^2 (55, 555 populations), and a stem density of 16/m^2 (44, 444 populations), using seed size grades of 45-5 mm diameter at a spacing of 75 cm (22 q/ha seed rate) ridged once 3-4 weeks after crop emergence for ware potato production were found to be optimum for higher tuber yield production. Total and marketable tuber yields obtained at these rates were 283 and 226 q/ha which are by far larger than the other treatments tested.

Reference

1. Seirt G. Wiersema. 1987. Effect of stem density on potato production. Technical Information Bulletin 1. International Potato Center, Lima, Peru. 15 pp.