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Influence of Seed Size and Spacing on the Yield of Potatoes

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Introduction: To secure an economic return from any crop, the adoption of an optimum seed rate is important. Apart from the other factors that influence crop-yields, such as manuring and tillage, the return to the cultivator is secured to a great extent by adjustment of the quantity of seed he uses per acre.

Seed rate directly influences the population or stand of the crop, which in turn, influences the ultimate yield. At the same time, a given seed rate cannot be rigidly specified for any particular crop, since it is itself governed by various factors such as (1) the particular variety used; (2) the normal rainfall and other climatic factors of the region; (3) the physical nature of the soil, like its water-holding capacity; (4) the supply of available plant food it contains; (5) irrigational and other facilities and (6) manuring.

As a result of various trials it has been confirmed that in the case of the potato crop, both the two factors, viz., the size of the tuber used as seed and the spacing of the seed in the rows at planting, considerably influence the yield of the crop at harvest. Thus, the need for fixing what may be termed "a safe general rule" for these two factors, with regard to conditions obtaining in the Nilgiris tract, was realised long ago, and experiments covering a series of seasons conducted to this end. The conclusions obtained on these points form the subject of this paper.

To begin with, it has to be admitted that local growers have been rather tardy to adopt the recommendations released as a result of experimentation. But, with the gradual spread of potato cultivation and increase in prices there has been in recent years a welcome change in favour of the use of the proper size of seed material and also its spacing while sowing. Use of very small-sized seed results in the reduction of both the average size of the harvested tubers and the over-all yield which, in turn, depress the commercial value of the produce and the net return to the grower. Optimum seed size and spacing result in a reduction of seed rate and economy in cultivation charges. The recent trends of falling crop-yields and lowering market-prices are largely

attributable to the indiscriminate use of small and ungraded tubers by cultivators, with the resultant production of undersized potatoes that are acceptable to the trader only at prices below par.

Work in India on the subject has been rather limited. By a series of trials at Uttar Pradesh, Mitra, (1), working on the local, small-sized variety, *Phulva*, concluded that seed tubers weighing 1 oz. were the best for getting optimum yields. Burton (2), reported that the average yield per acre was secured by a spacing of a foot between seed, over drills 26″ to 28″ apart. The most economical sett for production of marketable potatoes was fixed by Whitehead, McIntosh and Findlay (3), as seed weighing about 2 oz. and of the size of a hen's egg. Salaman (4), reviewing the bulk of the work both in England and other countries, concluded that the most profitable crop was derived from seed tubers between 1 oz. and 2 oz. These conclusions have been further confirmed in America by Rosa (5) Stewart (6) and Stuart and his collaborators (7).

In general, experimental evidence in the U. S. A. indicates that within reasonable limits, the larger the size of seed piece used, the higher will be the total yield. The grading adopted by the British Ministry of Food, in the case of tubers saleable as seed, viz., over 1¼ oz. and under 2¼ oz., in general, reflects the general agreement on the optimum seed size. In the Nilgiris, the ryots use 'chats', that is tubers weighing less than 1 oz. This definitely pulls down the yield. The tempting prices offered to the cultivator immediately after harvest force him to sell off all his produce and even the material he should normally reserve for seed, with the result that he keeps the 'chats' which would fetch anyway only very low prices, for use as seed. It is encouraging to note that the unsoundness of this practice is now being realised and, the necessity for good seed appreciated in a larger measure than hitherto, as a result of work at the Agricultural Research Station, Nanjanad.

Trials at the Agricultural Research Station, Nanjanad, on Seed Size and Spacing: With a view to prescribe the optimum size and spacing, experiments were conducted from 1933 to 1938 at this station. Five different sizes of seed tubers, viz., 1 oz., 1½ oz., 2 oz., 3 oz., and 4 oz., were studied, with three different spacings in the row, viz., 6″, 9″ and 12″. The distance between the rows was kept constant at 27″. The variety, Great Scot, was taken up as the material for study, in view of its popularity and other desirable characters as uniformly shaped, round tubers, flat eyes, early maturity, good yield and keeping quality.

For the season 1934—'35, three sizes of tubers and three spacings were used in replicated plots, with the following yields:—

TABLE I

(Treatments and acre yield in maunds of 25 lb.)

Spacing	6 inches			9 inches			12 inches		
Size	1 oz.	1½ oz.	2 oz.	1 oz.	1½ oz.	2 oz.	1 oz.	1½ oz.	2 oz.
Gross yield ...	781	752	878	602	787	800	574	647	755
Net yield (gross yield *minus* quantity of seed planted) ...	684	606	684	585	690	671	525	574	659

Conclusion: 2 oz. seed gave decidedly higher yields in all the spacings, and was the best for 6″ spacing. But, when the net yield was considered, it was found profitable to use 1½ oz. seed at 9″ spacing.

In the years, 1935–'36 and 1936–'37, the following treatments were adopted, using three levels each for seed size and spacing.

TABLE II

Effect of seed size and spacing on tuber yields

Treatments	Size	Spacing	1935—'36				1936—'37			
			Main Crop		II Crop		Main Crop		II Crop	
			Gross Yield	Nett Yield	Gross Yield	Nett Yield	Gross Yield	Nett Yield	Gross Yield	Nett Yield
			(in maunds of 25 pounds)							
A	1 oz.	6″	627	530	409	312	520	423	532	435
B	1 oz.	9″	534	469	286	222	470	406	467	392
C	1 oz.	12″	483	434	284	235	484	435	453	405
D	1½ oz.	6″	712	569	418	273	550	405	616	470
E	1½ oz.	9″	651	554	343	246	518	421	556	460
F	1½ oz.	12″	546	473	317	245	472	399	466	394
G	2 oz.	6″	821	628	551	358	658	464	664	470
H	2 oz.	9″	698	569	411	282	606	477	607	478
I	2 oz.	12″	693	596	358	261	556	460	461	364
Mean ...			640·3		375·2		537		535	
S. E. ...			26·01		33·4		23·8		15·1	
C. D. ...			75·9		97·4		66·4		33·9	
Z test Yes or No			Yes		Yes		Yes		Yes	

Note: Nett yield is gross yield—*minus* weight of seed planted.

Conclusion: The yield increased both with the increase in size of seed and increase in the seed rate. Two-ounce tubers, spaced between 6″ to 9″, gave economic returns.

During the year 1937—'38, four sizes of seed tubers were tried, with three spacings in the row. The twelve treatments were as follows :—

TABLE III

Effect of seed size and spacing on tuber yields

Treatments			1937—'38.			
			Main Crop		II Crop	
	Size	Spacing	Gross yield	Nett yield	Gross yield	Nett yield
			(in maunds of 25 lb.)		(in maunds of 25 lb.)	
A ...	1 oz.	6″	638	541	629	532
B ...	2 oz.	6″	769	575	747	553
C ...	3 oz.	6″	870	580	841	551
D ...	4 oz.	6″	943	556	958	571
E ...	1 oz.	9″	567	502	523	458
F ...	2 oz.	9″	702	573	630	501
G ...	3 oz.	9″	755	561	712	518
H ...	4 oz.	9″	789	631	782	527
I ...	1 oz.	12″	559	511	514	466
J ...	2 oz.	12″	714	617	531	434
K ...	3 oz	12″	762	617	609	464
L ...	4 oz.	12″	821	627	637	443
		Mean	741	566	676	501
		S. E.	40·2		35·9	
		C D.	115·5		99·4	
		Z test Yes or No.	Yes	No	Yes	No

Conclusion: From the results of both crops, it was seen that tubers of 1 oz. to 2 oz. size, spaced 6″ to 9″ apart, gave the best returns. The growth and vigour of haulms rose with increased size of seed and spacing.

Discussion: During the season, 1934—'35, the results showed that 2 oz. seed gave better results in all the spacings, and proved best with 6″ spacing. But, when the nett yield was considered, it was found most profitable to use 1½ oz. seed at 9″ spacing in the row. For the next crop-year, it was found that yields rose with the increases in size of seed and seed rate; 2 oz. seed at 6″ spacing being the most economical for the season. During later years, gross yields increased with closer spacing and also directly followed the increase in size of seed. 2 oz. seed tubers, spaced 6″ to 9″ in the row, returned optimum yields.

These results generally agree with the findings of foreign workers who prescribe the optimum size of seed as between 2 oz. and 2½ oz. The larger the seed size, the greater has been the yield, as pointed out by Wakankar and Singh (8). Larger seed produced more sprouts, greater yields and a larger number of tubers per hill. Sanborn (9) has recorded

that close spacing of the plant resulted in a lower percentage of dry matter in the crop. This finding seems quite logical, in view of the partial shading that will occur with closely spaced plants.

Ryots of the Nilgiri district use ½ oz. to 1 oz. tubers, spaced at 4″ to 6″ in the row, and 18″ between rows. These small-sized tubers are often those produced by plants affected by 'mosaic'. The effect of 'mosaic' disease on potatoes is to produce dwarfed, unhealthy plants, which produce mainly small tubers and in consequence, only very poor yields can be expected. By eschewing small tubers and insisting on the ideal seed size for planting, the percentage of 'mosaic' affecting the crop may be brought down considerably. In addition, the cultivator will gather definitely better yields and a greater income per acre.

Summary: Trials conducted at the Agricultural Research Station, Nanjanad, and elsewhere, in India and abroad, show that 1½ oz. to 2 oz. tubers, spaced at a distance of 6″ to 9′ in the row, and 27″ apart from row to row, give the most economic yield. The possibilities of further reducing the distance between rows are to be taken up shortly for investigation.

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