

SEED PERFORMANCE: CONTROL OF STEM NUMBERS, TUBER SET AND SIZE DISTRIBUTION AT HARVEST

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Total yield is not as important as obtaining a high yield of desirable tuber sizes at harvest. Therefore it becomes important to be able to control tuber size distribution. Generally, as tuber numbers increase, the average size at harvest decreases. Although complete control of tuber set can never be obtained because of the influence of temperature, we do have some control. One of the ways is by control of stem numbers per seed piece.

The number of stems arising from a seed piece can be influenced by; variety, seed tuber size, size of mother tuber from which seed is cut, physiological age or condition of seed and germination conditions after replanting. All of these factors are controllable to a certain degree.

As shown in Fig. 1, physiological age or performance of seed is influenced by the seed growing environment, storage environment and germination conditions. High temperature is the most important factor in these situations causing aging of seed which results in greater stem numbers per seed piece, decreased plant vigor, more rapid tuber development and earlier senescence of vines. This in turn results in lower total yield, smaller tuber sizes, poorer distribution of desirable sizes and less profit.

A flow chart of factors influencing tuber size and ultimate marketable yield is shown in Fig. 2. (from Beukema, Netherlands). Tuber number is a result of stem numbers and tuber number per stem. Tuber number per stem is influenced by density of plants, variety, soil condition (temperature, moisture, fertility) and climatic conditions such as temperature, light and moisture.

Stem number per unit area is affected by degree or number of sprouts, soil conditions (temperature, moisture) and damage due to insects, wind and disease which may decrease stem number per seed pieces. Sprout number per seed piece is influenced by physiological age of seed, chemical treatment of seed, variety and seed piece size.

The upper part of the flow chart shows that tuber yield is influenced by number of growing days and production per day. Production per day is the net result of assimilation minus the loss from respiration because of high temperatures.

Assimilation is the combining of carbon dioxide and water by leaves (photosynthesis) to form carbohydrates which are translocated into the tubers. This is influenced by LAI (foliage size) amount of light, moisture, available nutrients and temperature.

The number of growing days of a particular crop is the result of actual growing period which is determined by fertilization, variety, condition of seed, etc. Available growing period is the number of frost free days and potential growing period is determined by how well the available growing period is utilized.

This flow chart was developed in the Netherlands where whole seed is used entirely. In the United States, the preponderance of seed is cut from larger mother tubers. This introduces an added variable which can influence stem number per seed piece and performance.

With varieties such as Nooksack and Shepody which have few eyes poorly distributed, it is possible to obtain cut seed pieces with as high as twenty percent blind (without eyes) Fig. 3. In these varieties, not only is amount of blind seed increased but also stem number per seed piece is influenced. As shown in Table 1, as mother tubers from which seed is cut becomes larger, the number of eyes on the cut seed decreases (2 oz seed) as well as the number of stems produced. With Nooksack and Shepody, lack of tuber set is a problem resulting in excessive tuber size at harvest. The use of larger mother tubers in cutting 2 oz seed resulted in decreased yield because of a decrease in stem numbers and tuber set (Table 1). There is no doubt that for varieties such as Shepody and Nooksack it is advisable to use smaller mother tubers (less than 8 oz) for cutting into seed pieces.

Russet Burbank mother seed tubers generally have adequate number of eyes. However, large mother tubers from which seed is cut can result in decreased yield as shown in Table 2. This was an experiment set up years ago by J. E. Kraus of the University of Idaho at the Aberdeen Experiment Station. As shown in Table 2, the use of large mother tubers with Russet Burbank does not have quite the same effect in reducing stem numbers as with Nooksack. The data was not statistically analyzed, however, there was a trend of lower yields with larger mother tuber sizes, i.e. 8 oz. mother tubers cut to 2 oz size, yielded 31.9 tons per ha, whereas, a 2 oz mother tuber yielded 36.4 T/ha, or a 12 oz mother tuber cut to 3 oz yielded 33.9 T/ha as compared to a 3 oz mother tuber yield of 37.2 T/ha of U.S. No. 1 potatoes. One oz. cut seed yielded less than 2 or 3 oz cut seed despite smaller mother tuber size.

Fig. 1. Diagram showing factors which influence physiological age (seed performance), factors which are influenced by age and the results of the influence.

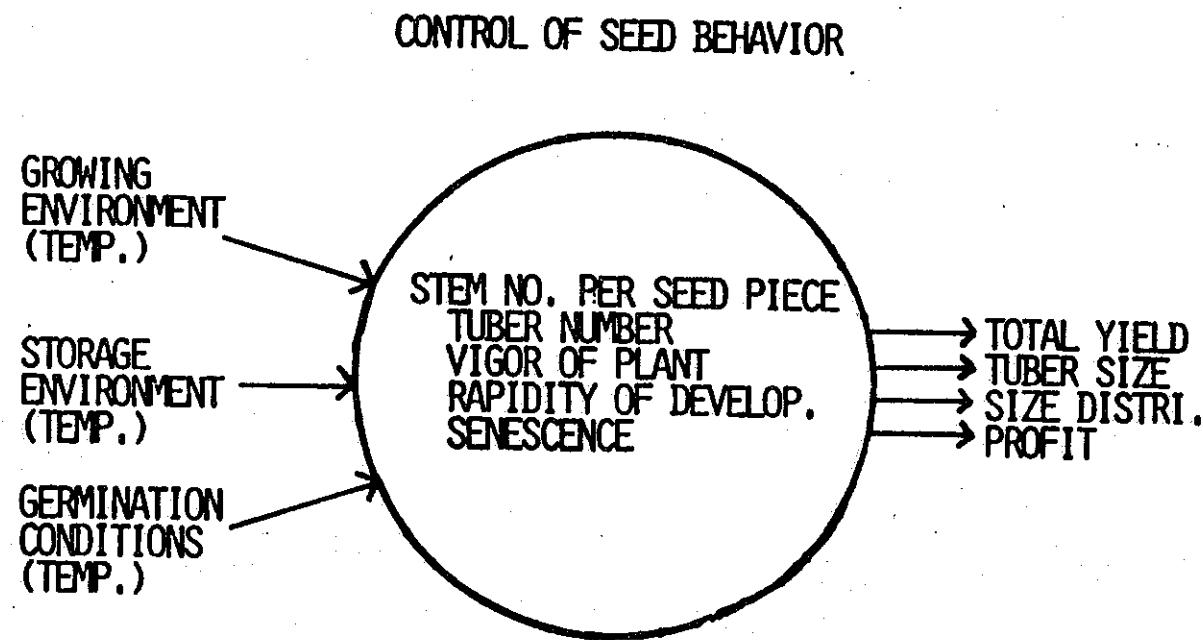


Fig. 2. Flow chart showing all of the factors which have input in determining tuber size and marketable yield at harvest. (From Beukema, Netherlands).

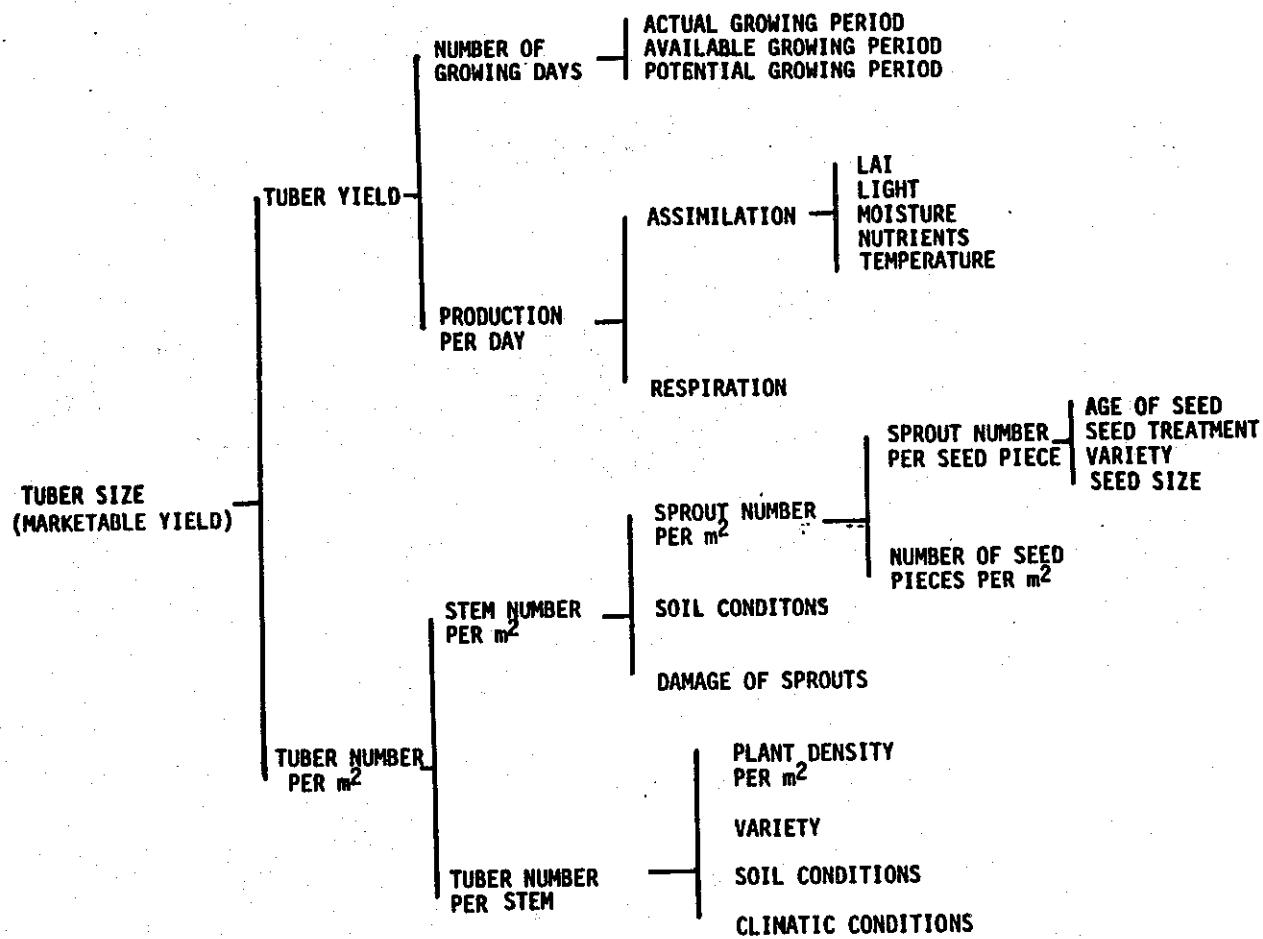


Fig. 3. Percent blind seed produced from various size seed cut from a random sample of mother tuber sizes of Nooksack and Russet Burbank seed potatoes.

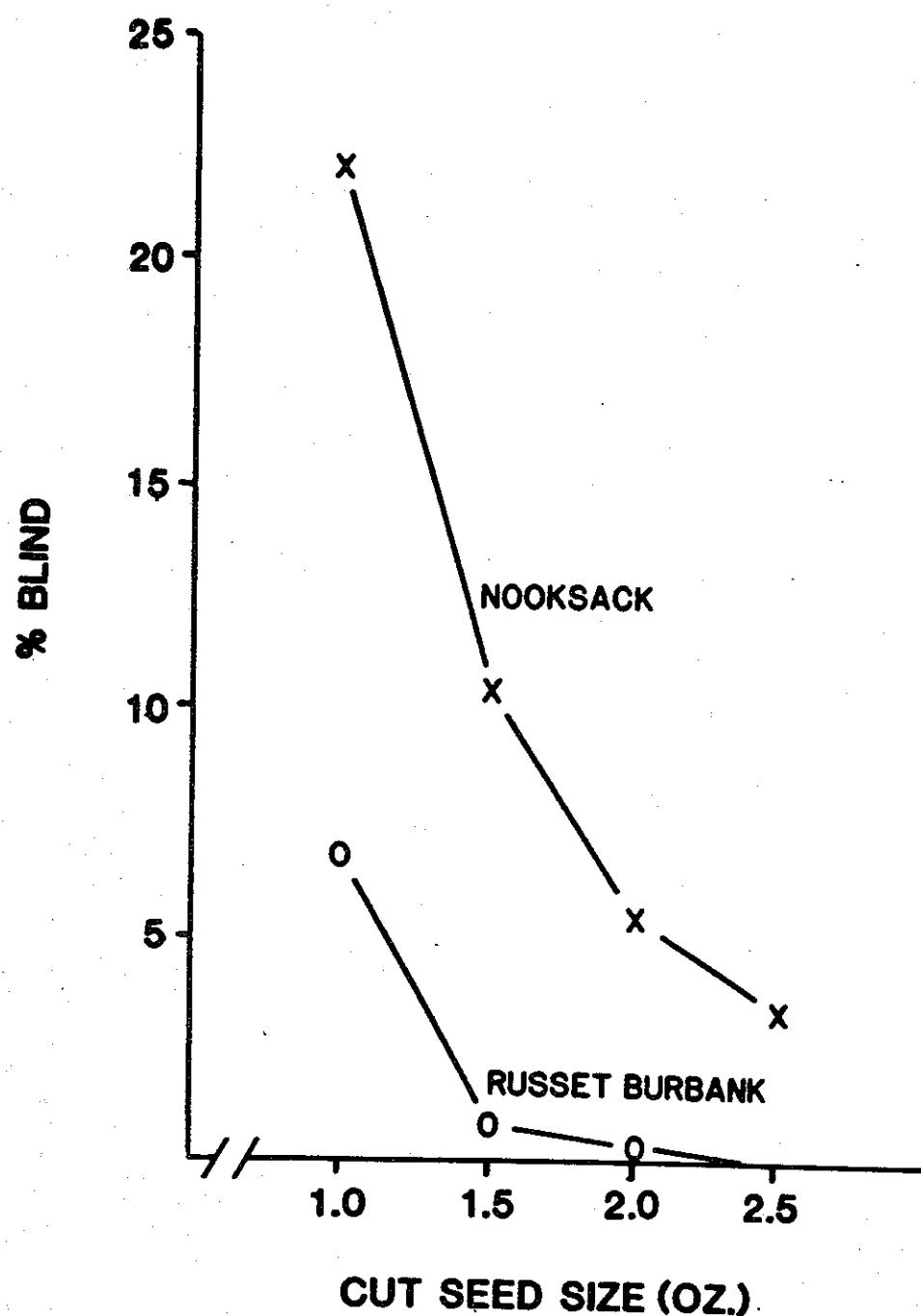


Table 1. The results of different Nooksack mother tuber sizes cut to 2 oz. seed pieces, on eye number, stem number, percent stand and yield. All blind cut seed was removed.

MOTHER TUBER SIZE (oz)	NOOKSACK					YIELD TONS/ha	
	MOTHER TUBER SIZE, EYE AND STEM NUMBER / SEED PIECE, PERCENT STAND AND TOTAL YIELD		PERCENT BLIND	PERCENT STAND			
	EYE NO. / SEED PIECE	STEMS/ SEED PIECE					
3-5	2.5	1.7	0	95	67		
5-7	2.2	1.6	0	96	64		
7-9	2.0	1.6	0	89	58		
9-11	1.9	1.5	0	90	56		
LSD	**	**		NS	NS		
LINEAR	**	**		*	*		

Table 2. The influence of mother tuber size and cut seed size on stem number and yield of Russet Burbank potatoes. (Kraus, University of Idaho).

MOTHER TUBER SIZE (oz)	CUT SEED SIZE (oz)	STEMS/ SEED PIECE	YIELD TONS/ha	
			TOTAL	U.S. NO.1
1	1	2.5	41.6	31.7
2	1	2.2	39.1	29.7
4	1	2.3	40.6	30.1
2	2	3.3	46.7	36.4
4	2	3.3	45.9	35.2
8	2	2.8	43.0	31.9
3	3	4.2	46.0	37.2
6	3	3.1	45.6	36.2
12	3	3.5	45.4	33.9