

ALTERING YIELD PROFILE WITH GIBBERELIC ACID SEED PIECE TREATMENTS

by

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The cultivars Shepody, Nooksack and, to some extent, Ranger Russet tend to produce many large tubers over 16 ounces, with some tubers over 20 ounces in weight. For the seed grower this is undesirable, since large tubers give many blind seedpieces. For the processor, this trait is also undesirable because large tubers (over 16 ounces) can not be handled by processing machinery and must be cut by hand before going through the line.

A study was initiated to reduce the average tuber size of Shepody, Nooksack and Ranger Russet without decreasing yields or increasing seed costs. Tuber size may be reduced by higher plant densities or increasing stem numbers and thus tubers set per hill. The problem with higher plant densities is an increase in the amount and cost of seed per acre. A Gibberellic Acid (GA_3) seedpiece dip was used to increase the number of stems per hill to alter yield profile so more small tubers and fewer large tubers were produced.

GA_3 is a natural plant growth regulator that is registered for use on seed potatoes. The concentrations used in the study are within the recommended rates.

The objectives of the study were:

1. To increase the number of stems per seedpiece with a preplant GA_3 seedpiece dip.
2. By increasing stem numbers, increase the number of tubers set per hill and thus decrease the average size of the tubers and reduce the number of tubers weighing more than 16 ounces.

MATERIALS AND METHODS

Shepody and Ranger Russet were tested for 3 years (1989, 1990 and 1991) and Nooksack was tested during the 1991 growing season only. Seed tubers were cut into 2-ounce seedpieces, then dipped in a solution containing 0.5, 1 or 2 ppm GA_3 . Control seedpieces were dipped in water. After treatment, the seedpieces were air-dried for approximately 15 minutes until the surface of the seedpiece was no longer wet. The seedpieces were planted at the Othello Research Station one day following GA_3 treatment.

This Presentation is part of the Proceedings of the 1992 Washington State Potato Conference & Trade Fair.

Plots consisted of 25 seedpieces spaced 9.3 inches apart, in rows 34 inches apart. Each cultivar was tested independently using a randomized complete block design with five replicates.

Irrigation water was applied by overhead sprinklers as needed. In 1989 and 1990, 320 lb/A nitrogen was applied preplant. In 1991, 100 lb/A Nitrogen was applied preplant and 150 lb/A was side dressed in 2 applications before row close.

Each year, seedpieces were planted in late April. Shepody plants were harvested after 138-150 days and Ranger and Nooksack plants were harvested after a 166 to 167-day growing season.

RESULTS

SHEPODY

GA₃ seedpiece dips had no effect on percent stand of Shepody. Control plants averaged 1.9 stems/seedpiece, 0.5% GA₃ had no effect on stem number and GA₃ seedpiece dips at 1 and 2 ppm increased stem number to 2.5 stems/seedpiece (Table 1).

Total yield of Shepody (in cwt/acre) was not affected by GA₃ seedpiece treatments. Also, U.S. #1 and U.S. #2 yields were not affected by the seedpiece dips (Table 2). The yield profile, however, was shifted towards smaller tubers.

The yield of tubers between 4 and 12 ounces from the control plants accounted for 230 cwt/acre or 55% of total yield. Yield of the 16-20 ounces and over 20 ounce categories each accounted for 10% (58 cwt/acre) of the yield (Figure 1). GA₃ seedpiece treatment of 1 and 2 ppm were equally effective in reducing the over size tubers and increasing the yield of smaller tubers. The yield of tubers less than 4 ounces was doubled with GA₃ at 1 or 2 ppm, and yield of 4 to 8 ounce tubers was increased by 25 cwt/acre. Yield of 8 to 12 ounce tubers was not affected by GA₃. GA₃ seedpiece dips at 1 and 2 ppm decreased the yield of 16 to 20 ounce tubers by at least 40% and the yield of tubers greater than 20 ounces was decreased by one-half.

Total yield of Shepody was not affected by GA₃ and the decrease in the percentage of large over sized tubers (those over 16 ounces) was accompanied by an increase in the percentage of tubers 8 ounces or less.

GA₃ had no affect on yield (total, U.S. #1's or U.S. #2's) of Shepody. GA₃ seedpiece dips of 1 and 2 ppm were effective in altering the yield profile towards more small tubers and fewer over size tubers. To produce the same effect, a GA₃ concentration of 1 ppm would be more economical than the higher concentration.

RANGER RUSSET

As with Shepody, percent stand was not affected by treating the seedpieces with GA₃. Stem number did increase slightly with 2 ppm GA₃, to 2.9 stems per seedpiece from 2.0 stems per seedpiece for the control (Table 1).

GA₃ seedpiece treatments significantly affected the yield of Ranger Russet (Table 2). Total yields were decreased by 49 cwt/acre and U.S. #1 were decreased by 63 cwt/acre with 2.0 ppm GA₃. Treating seedpieces with 0.5 ppm prior to planting increased total yield by 46 cwt/acre. The yield of U.S. #2 was unchanged with GA₃ except for 1 ppm which increased the U.S. #2 by 33%.

The effect of GA₃ on yield profile is shown in Figure 1. GA₃ at all concentrations used, more than doubled the yield of tubers less than 4 ounces, from 34 cwt/acre to approximately 80 cwt/acre. The yield of tubers between 4 and 8 ounces was also increased by all GA₃ treatments, and 0.5 ppm was most effective. All size categories greater than 8 ounces were in decreased with GA₃.

On Ranger Russet, GA₃ was effective in increasing the yield of small tubers less than 8 ounces and decreasing the yield of tubers larger than 8 ounces, but the treatment also decreased total yields and increased the proportion of U.S. #2. GA₃ seedpiece treatments on Ranger are not recommended.

NOOKSACK

GA₃ seedpiece treatment did not affect percent stand nor did it increase stem numbers of Nooksack, which averaged approximately 2 stems per seedpiece for all treatments (Table 1).

Total yield and U.S. #1 were increased with GA₃ treatment (Table 2). Two ppm was most effective. This concentration of GA₃ increased total yields by 64 cwt/acre and U.S. #1's by 51 cwt/acre. U.S. #2's were also affected by GA₃, increasing slightly with 1 and 2 ppm GA₃. This is based on data from one growing season, and additional studies are needed.

Figure 1 shows the yield profile of Nooksack divided into 4 ounce tuber size categories. Tubers less than 4 ounces and between 4 and 8 ounces increased substantially with 2 ppm GA₃. Yield of tubers between 8 and 12 ounces was not affected. With 2 ppm GA₃, the yield of large tubers 12 to 16 ounces, 16 to 20 ounces and especially over 20 ounces were reduced. With GA₃ treatment, the yield of tubers weighing more than 20 ounces was reduced by one-half.

Nooksack was very responsive to GA₃ seedpiece treatments. The percentage of oversize tubers, especially tubers greater than 20 ounces, was reduced and the number of small tubers was significantly increased.

CONCLUSIONS:

Gibberellic acid seedpiece dips when applied at the label rate, were effective in decreasing yields of large tubers and increasing yields of small tubers of Nooksack and Shepody. Ranger Russet, which tends to produce smaller tubers than both Nooksack and Shepody, was also affected by the seedpiece treatments but total yields were reduced and more U.S. #2's were produced.

Table 1. The effect of Gibberellic Acid (GA_3) seedpiece dips on percent stand and number of stems per seedpiece of the cultivars Shepody, Ranger Russet and Nooksack.

Treatment	Stand	Stems per Seed Piece
	--- % ---	-- count --
SHEPODY		
Control	96.6	1.9
0.5 ppm GA_3	98.9	2.1
1.0 ppm GA_3	99.5	2.5
2.0 ppm GA_3	98.1	2.5
RANGER		
Control	95.6	2.0
0.5 ppm GA_3	98.1	2.6
1.0 ppm GA_3	98.4	2.7
2.0 ppm GA_3	94.1	2.9
NOOKSACK		
Control	99.2	1.9
0.5 ppm GA_3	100.0	1.8
1.0 ppm GA_3	99.2	2.0
2.0 ppm GA_3	99.2	2.1

Table 2. The effect of Gibberellic Acid (GA_3) seedpiece dips on yield (cwt per acre) of the cultivars Shepody, Ranger Russet and Nooksack.

Treatment	Total Yield	US #1 (4-16 oz.)	US #2
	----- cwt per acre -----		
SHEPODY			
Control	559	312	105
0.5 ppm GA_3	531	314	105
1.0 ppm GA_3	544	311	118
2.0 ppm GA_3	525	307	111
RANGER			
Control	568	427	45
0.5 ppm GA_3	614	444	35
1.0 ppm GA_3	585	389	60
2.0 ppm GA_3	519	364	47
NOOKSACK			
Control	484	337	40
0.5 ppm GA_3	526	363	55
1.0 ppm GA_3	526	340	68
2.0 ppm GA_3	548	388	68

Figure 1. Yield profiles (in cwt per acre) of the cultivars Shepody, Ranger Russet and Nooksack as affected by Gibberellic Acid (GA_3) seedpiece dips.

