the sprayed plots as indicated by total yield. Data for 1964 and 1965 substantiate this interpretation since the fruits were picked by treatments at a time (151 days) when most fruits seemed to be in the red state without being overripe. Heinz 1370 as compared with KC-146 appeared to be better suited for delay in picking because its fruits are much slower in breakdown when left on the vines. Futhermore, slight varietal differences with respect to spray concentrations were observed, with KC-146 more negatively responsive to concentrations above 2000 ppm than Heinz 1370.

Research is being continued on the cultivar x spray concentration interrelationship.

The commercial value of Alar as a spray was not rated. However, if the 1965 values for red No. 1 and 2 are calculated on an acre basis (5125 plants per acre) an increase of 3.6 tons (from 11.1 to 14.7 tons) would have been achieved. Probably, better yields could also be expected where the growing season is longer and the first frost appears after the middle of September. To date (May 1, 1966), Alar has not been cleared for commercial use on tomatoes.

A Method for Estimating Yields of Shelled Lima Beans

By C. L. Tucker, *Department of Agronomy, University of California, South Coast Field Station, Santa Ana, California*

A major consideration in determining the number of entries in a yield trial is the amount of time and effort involved with each plot. Commercial methods of harvesting such crops as fresh lima beans and shelled peas are not suitable for experimental plots. The present experiment was designed to evaluate the feasibility of using indices (such as shelled weight/unshelled pod weight) in estimating yield of shelled seeds for large field plots from small samples.

Questions to be answered by this experiment were: (1) Are estimated weights arrived at by indices biasted? (2) Are discrepancies of actual to estimated weights of small enough size so that genetic differences can be resolved? (3) What is an acceptable sample size?

Plots were located in two commercial Concentrated Fordhook lima bean fields near Oxnard, California. Fields were at the fresh harvest stage of maturity and were being harvested at the time experimental plants were removed. All plants from a 10-foot section of row were pulled, and the pods were stripped and weighed. Two random samples of pods weighing approximately 940 grams were removed, shelled, and weighed. Then the remainder of the pods were shelled and weighed. This procedure was followed for six contiguous sections of the same row in each field.

Three indices for each 10-foot section of row were calculated. One index was determined by dividing the shelled weight of the first sample drawn (Sample 1) by the total unshelled pod weight of that sample. An index was arrived at in a similar manner using the second sample (Sample 2) drawn. The weights from Samples 1 and 2 were combined and averaged, thus allowing the third index to be calculated. The estimated weights of each 10-foot section are the product of the total weight and the indices of that respective section. The actual weight and the discrepancy between actual and estimated weights are shown in Table 1 below.

The same indices mentioned above were used to estimate the shelled weight of the total 60 feet of row harvested in each field. These estimated weights are the product of the indices for each 10-foot section and the total weight from the 60-foot plot. The actual weights and the discrepancies between them and the estimated weights are presented in Table 2. Each test contained the discrepancy results from Samples 1, Samples 2, and the two samples combined. A "t" test for each 10-foot row was calculated to establish if there was an indication of bias in the samples taken. In all cases the "t" value obtained was smaller than the tabular "t" value at the 5% level for five degrees of freedom, indicating that there was no significant statistical bias.

Deviations or discrepancies from estimated to actual weight for each 10-foot section in Field 1 were less than 5% in all but one case. In Field 2 four

Table 1. Shelled Weights and Discrepancies For 10-Foot Sections of Row

10-Foot Section of Row	Percent Discrepancy: Using Index From Sample 1	Using Index From Sample 2	Using Index From Samples 1 & 2 Combined	Actual Weight (grams)
Field 1				
1st	1.1	−4.2	1.5	1500
2nd	1.2	−0.7	0.1	1630
3rd	1.7	1.7	1.7	1572
4th	4.4	−5.7	0.6	1537
5th	1.1	.08	0.8	1601
6th	−0.3	−3.2	1.9	1665
Mean	1.5	−1.9		
Field 2				
1st	3.2	−0.5	1.5	1510
2nd	−4.4	0.1	2.1	1396
3rd	5.7	0.5	3.1	1287
4th	3.7	2.8	3.3	1230
5th	8.5	−5.6	1.6	1349
6th	5.5	−3.5	0.5	1446
Mean	3.7	−1.0		

estimates deviated more than 5% (see Table 1).

Discrepancies between estimated and actual weight for the total 60 feet of row (Table 2) were also quite small. Field 1 had four estimates above 5% and Field 2 had three above 5% when individual samples were used. When indices from combined samples were used, only one estimate deviated more than 5%.

A 940-gram sample represents between 25% and 30% of the total pod weight of a 10-foot row. However, this sample is between 4% and 5% of the weight of the total row 60 feet long.

Confidence limits (95%) for the mean discrepancies are given in Table 2. There is an indication of added precision when using the results from two combined samples. If differences between entries are expected to be low (in the magnitude of 5%) then duplicate samples would be necessary. However, if differences of 10% exist, then a single sample should be sufficient.

Table 2. Shelled Weights and Discrepancies For 60 Feet of Row

10-Foot Section of Row	Percent Discrepancy		
	Using Index From Sample 1	Using Index From Sample 2	Using Index From Samples 1 & 2 Combined
Field 1			
1st	7.6	1.9	4.8
2nd	− .2	−2.0	−2.3
3rd	−5.9	−5.9	−5.9
4th	7.9	−2.5	2.7
5th	2.4	2.1	2.2
6th	− .4	−3.4	−2.0
Mean	1.9 ±4.5*	1.6 ±2.5*	.1 ±3.2*
Total weight = 9505 gr.			
Field 2			
1st	4.1	.4	2.2
2nd	−6.4	−2.5	−4.6
3rd	3.8	−1.3	1.3
4th	2.6	1.5	2.0
5th	4.6	−8.9	−2.0
6th	14.0	4.6	9.4
Mean	3.8 ±5.2*	1.0 ±3.7*	1.4 ±3.8*
Total Weight = 8220 gr.			

*95% confidence limits

An Effect of Row Orientation on Onion Development

By Jules Janick[2] and Flavio A. A. Couto[3]

An apparent difference in premature bolting was noticed between paired rows of onions planted in an east-west direction during the 1963 season in Vicosa, Minas Gerais, Brazil. Eight varieties of onions had been seeded April 14 (fall), transplanted to the field on June 7 (winter), and harvested in December (summer). The varieties were planted consecutively in the field in a serpentine arrangement. Double rows, 40 cm. apart, were separated by an irrigation furrow, 60 cm. wide, creating a "north" and "south" oriented row. The number of double rows per variety varied from 2 to 18.

Onions from each row were classified during harvest into three classes: bolters (flowering); non-bolters, tops down (mature); and non-bolters, tops upright (immature). The percentage of the non-flowering onions with tops down was used as an index of maturity.

The effect of row orientation on premature bolting is shown in Table 1. Chi Square analysis indicated that the increased flowering in the south as compared to the north rows, as well as the differences between varieties, was highly significant. The percentage flowering in the south row was approximately three times as great as the north row and there was no variety x position interaction (Figure 1). Highly significant varietal differences in maturity were found but none were attributable to row orientation. In general, the early maturing varieties had a low incidence of premature bolting.

In three of the varieties (Baia Periforme, Sintese 13 and 14) an analysis of premature bolting in the east and west side of the field as well as by north and south row orientation could be made (Table 2). Significantly, greater flowering was found in the south as compared to the north rows; no differences were attributable to the east and west sides of the field.

Microclimate effects have been associated with row and plant orientation. Effects of row orientation in celery have

Table 1. Effect of row orientation on premature bolting of eight onion varieties, Viscosa, Minas Gerais, Brazil, 1963.

Variety	Premature bolting[1] Row orientation North	South	Weighted average	Total plants
	%	%	%	No.
Excel Yellow Bermuda	0.00	0.04	0.02	5456
Baia Periforme	2.77	5.96	4.32	15823
Sintese 36	7.42	29.96	17.27	1372
Tipo Amarela Globular	8.74	27.36	18.34	638
Sintese 14	11.97	29.60	20.40	1456
Sintese 22	8.69	31.48	20.44	2994
Rio Grande	9.89	37.58	23.68	946
Sintese 13	12.84	36.06	24.32	1956
Total	4.43	12.75	8.54	30441

[1] Differences in variety and row orientation highly significant

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