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AGRONOMY NOTES

DEPARTMENT of AGRONOMY ————— Lexington. 40506.

Soybean Seed Quality Survey
by
Dennis M. TeKrony

Introduction

During the past four years soybean acreage has nearly tripled in Kentucky to 1.1 million acres in 1973. Even though the total acreage has increased substantially, the average yield per acre has declined slightly during the same period to 28 bushels per acre in 1973. Why this low statewide average yield when we know that some Kentucky farmers consistently produce yields of over 40 bushels per acre? Many factors can contribute to this problem including; improper use of herbicides and pesticides, inadequate soil fertility, non-adapted varieties, low quality planting seed, and timely management of all production practices. The objective of this survey was to determine the varieties and quality of soybean seed being planted by Kentucky farmers in the major soybean producing areas of the state in the spring of 1973. To accomplish this, personnel were hired that lived in the areas and could readily travel to farms and collect samples at planting time.

At the time of collection, the samplers acquired the following information from the person running the planter or from the farmer if he was readily available:

1. Crop variety
2. Acreage being planted with this lot of seed
3. Source of seed (seedsmen, homegrown, or neighbor)
4. Was the seed certified or non-certified?
5. Had the seed been cleaned and by whom? (farmer or commercial)
6. Had the seed been tested for purity and germination?

After obtaining this information a sample was secured of sufficient size for testing purposes. The seed lot was identified, as was the county where the sample was drawn. Within one week the samples were moved to the University of Kentucky storage facilities and maintained at cool temperatures and low humidity until testing could be accomplished. All samples were tested at the University of Kentucky seed testing laboratory for purity, germination, and the presence of corn and objectionable weeds. For this survey, those weeds which were considered to be objectionable included: giant foxtail, giant ragweed (horseweed), cocklebur and johnsongrass.

A Word of Caution

The reader should be aware that the information reported in this survey can only be as accurate as the advice received from the personnel running the planting equipment. After reviewing the results, it became quite evident some farmers did not clearly understand the difference between the analysis tag and the certification tag. Therefore, only those samples which either had certification tags present or could be positively identified as coming from a certified seed source were counted as certified seed, regardless as to whether the farmer answered "yes" or "no" to whether the seed was certified at the time of collection.

Area Surveyed

A total of 354 soybean samples was collected from 19 counties located west of Interstate-65 in Kentucky. The approximate number of samples collected in each county are shown on Figure 1, with the largest number of samples coming from those counties where the personnel collecting the samples lived. For convenience in interpreting these results, the counties were grouped into four areas commonly identified by the University of Kentucky Agricultural Extension Service. (The only exception being that Breckinridge County was included in the Green River Area). The four areas and the total number of samples collected from each area were as follows:

<u>Area</u>	<u>Number of Samples</u>
Purchase	67
Pennyrile	61
Green River	136
Mammoth Cave	90
Total =	354

Since each of these areas represents diverse soil types, crop rotations, and previous histories of soybean production, it was felt that the sample was representative for the State. Based on the information provided, the 354 soybean samples collected provided seed for planting 44,847 acres in the 19 counties surveyed. This acreage was approximately 5% of the total acreage planted to soybeans in Kentucky in 1973.

Soybean Variety Distribution

The number of varieties reported in the survey as well as the frequency and acreage planted with each, can be found in Table 1. There were 22 yellow-seeded soybean varieties and 1 black-seeded variety in the survey. The number of samples occurring for each variety ranged from 1 for several varieties to 93 for the York variety. Eighty-five percent of the acreage planted in the survey was planted with 7 varieties, York, Dare, Kent, Cutler, Cutler 71, Hood, and Clark 63. The York and Dare varieties made up 45% of the total acreage planted.

The distribution of the twelve leading soybean varieties in the four areas sampled, is shown on Table 2. It can readily be determined that variety adaptation and maturity are directly related to the areas sampled. Henceforth, Kent made up 36% of the samples collected in the Green River Area, whereas York and Dare were the leading varieties for the Purchase, Pennyrile, and Mammoth Cave areas. More than 90% of the acreage planted in the survey was with varieties which have been recommended and are adapted in the state.

Source of Seed

It can be observed from Table 3 that 47% of the total samples in the survey were purchased from seedsmen, whereas 40% were homegrown, and 13% were acquired from neighbors. This represents a nearly equal distribution for the total survey between seedsmen purchases and seed originating from homegrown sources. A similar distribution trend is noted for the Pennyrile Area. However, a quite different distribution trend was noted in the other three areas sampled. In the Mammoth Cave area 66% of the samples were acquired from seedsmen sources, whereas in the Green River and Purchase Areas, only 36 and 40% respectively were seedsmen purchases. On the other hand, 50% of the

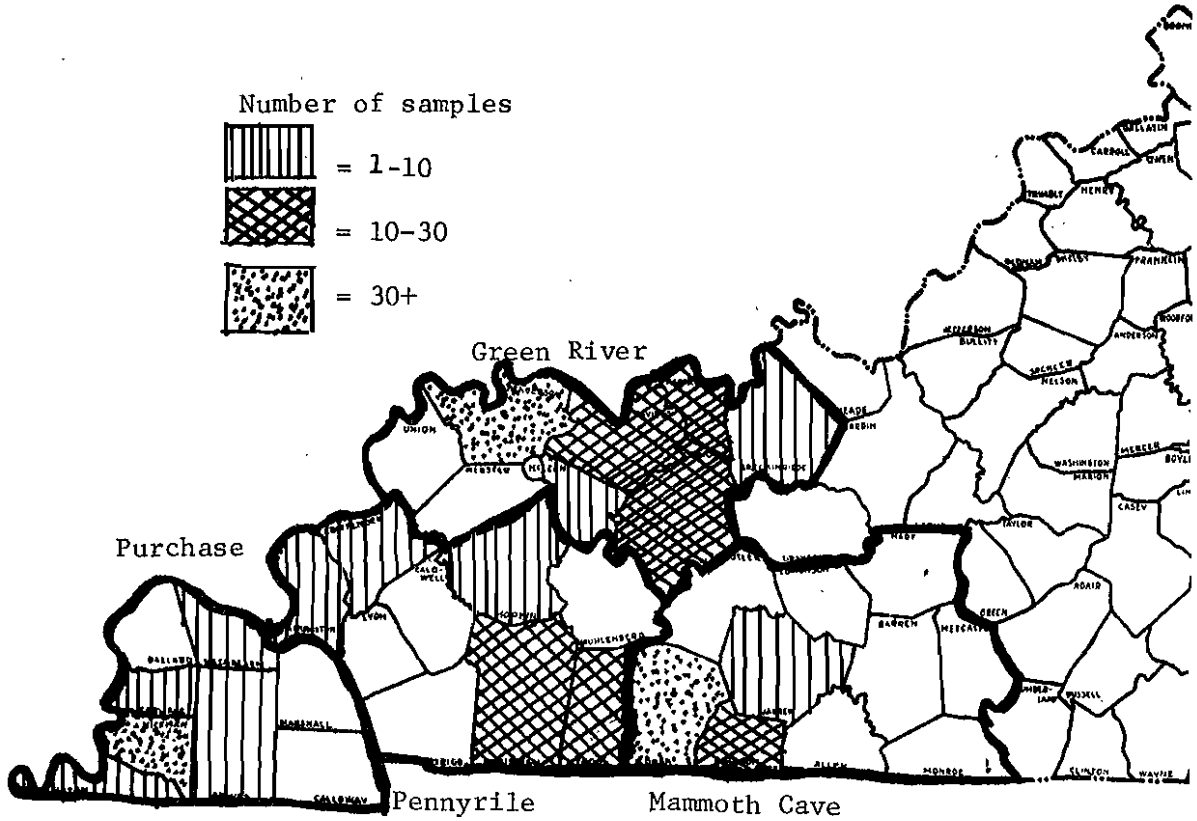


Figure 1. Area and county distribution of samples in survey.

Table 1. Number of soybean varieties found in survey and acreage planted with each.

<u>Variety</u>	<u># Samples</u>	<u>% of Total</u>	<u>Acres Planted</u>
Wayne	8	2.3	484
Seedmaker 1-E	1	0.3	600
Calland	8	2.3	1,223
Clark 63	17	4.8	1,240
SRF-400	2	0.6	150
Williams	1	0.3	200
Cutler 71	20	5.6	1,672
Cutler	29	8.2	2,441
Custer	1	0.3	-----
Kent	52	14.7	8,425
SRF-450	7	2.0	1,750
Essex	2	0.6	34
Mack	6	1.7	470
Dare	70	19.8	9,500
York	93	26.3	13,112
Hood	21	5.9	2,105
Lee	4	1.1	642
Ogden	3	0.8	175
Pickett 71	1	0.3	200
<u>Others</u>			
Black Wilson	1	0.3	20
XK-505-605	2	0.6	34
Hi Bien	1	0.3	10
Mixed Varieties	2	0.6	125
Unknown	2	0.6	235
Total	354	100.0	44,847

Table 2. Number and percentage of leading soybean varieties occurring in each area sampled.

<u>Varieties</u>	<u>Purchase</u>		<u>Pennyrile</u>		<u>Green River</u>		<u>Mammoth Cave</u>	
	<u>Number Samples</u>	<u>% in Area</u>	<u>Number Samples</u>	<u>% in Area</u>	<u>Number Samples</u>	<u>% in Area</u>	<u>Number Samples</u>	<u>% in Area</u>
Wayne	1	1.5	0	-	5	4	2	2
Calland	0	-	0	-	8	6	0	-
Clark 63	1	1.5	2	3	13	10	1	1
Cutler 71	0	-	4	7	6	4	10	11
Cutler	1	1.5	9	15	14	10	5	6
Kent	1	1.5	1	2	49	36	1	1
SRF-450	1	1.5	0	-	4	3	2	2
Mack	6	9.1	0	-	0	-	0	-
Dare	7	10.6	16	26	11	8	36	40
York	32	47.0	16	26	15	11	30	33
Hood	7	10.6	8	13	6	4	0	-
Lee	4	6.1	0	-	0	-	0	-
Others	6	9.1	5	8	5	4	3	4
TOTAL	67	100	61	100	136	100	90	100

samples planted in the Green River Area were from homegrown sources and 14% from neighbor sources. While in the Purchase Area 40% was acquired from homegrown sources, and 20% from neighbors.

Table 3. Percentage and number of samples acquired from each source compared for each area and the total survey.

Percent of Total for each Area

<u>Area Sampled</u>	<u>Seedsmen</u>	<u>Home Grown</u>	<u>Neighbor</u>	<u>Total Number of Samples in Area</u>
Purchase	40	40	20	67
Pennyrile	52	43	5	61
Green River	36	50	14	136
<u>Mammoth Cave</u>	<u>66</u>	<u>24</u>	<u>10</u>	<u>90</u>
TOTAL	47	40	13	353

Certified vs. Non-Certified Seed

Approximately one-third (108 samples) collected in the survey were positively identified as certified seed (Table 4). When examined on an area basis, the percentage of certified samples ranged from 20% in the Green River Area to 44% in the Pennyrile Area. It can be observed that more than 50% of the samples originating from the seedsmen's source were certified seed. On the other hand, a small percentage of the samples originating from homegrown or neighbor sources were certified.

Table 4. Number of samples reported as certified and non-certified seed.

<u>Area Sampled</u>	<u>Source</u>						<u>Total Samples Certified in Area</u>	
	<u>Seedsmen</u>		<u>Home Grown</u>		<u>Neighbor</u>		<u>Number</u>	<u>Percent</u>
	<u>Cert</u>	<u>Non-Cert</u>	<u>Cert</u>	<u>Non-Cert</u>	<u>Cert</u>	<u>Non-Cert</u>		
Purchase	13	14	8	19	3	10	24	36%
Pennyrile	22	10	4	22	1	2	27	44%
Green River	25	23	2	66	0	19	27	20%
<u>Mammoth Cave</u>	<u>28</u>	<u>31</u>	<u>2</u>	<u>20</u>	<u>0</u>	<u>9</u>	<u>30</u>	<u>33%</u>
TOTAL	88	78	16	127	4	40	108	31%

Samples Cleaned and Tested

Only 2% of the samples planted in this survey had not been cleaned prior to planting (Table 5). Ninety-five percent of the seed cleaned had been cleaned in commercial seed processing plants, whereas 3% had been cleaned by farmers. The 6 samples which had not

been cleaned prior to planting originated from homegrown sources.

Table 5. Number of samples cleaned, and by whom, prior to planting.

Seed Cleaned by:	Source			Total Samples	% of Total
	<u>Seedsmen</u>	<u>Home Grown</u>	<u>Neighbor</u>		
Farmer	0	15	3	18	3%
Commercially	158	120	39	317	95%
Seed not Cleaned	0	6	0	6	2%

Even though 98% of the samples planted in the survey had been cleaned, only 86% of these samples had been tested for purity and germination prior to planting (Table 6). Approximately 95% of those samples planted in the Purchase, Pennyrile, and Mammoth Cave Areas had been tested prior to planting, while only 71% of the samples in the Green River Area had been tested. When examined as to source, it can be determined that nearly all of those samples sold by seedsmen had been tested, whereas only 75% of the samples from homegrown and neighbor sources had been tested. It can also be observed that approximately 50% of the samples planted in the Green River Area, which originated from homegrown sources, had not been tested prior to planting.

Table 6. Number of samples that were tested for purity and germination before planting.

Area Sampled	Source						Total Samples Tested in Area	
	Seedsmen		Home Grown		Neighbor		Number	Percent
	<u>Tested</u>	<u>Not-tested</u>	<u>Tested</u>	<u>Not-tested</u>	<u>Tested</u>	<u>Not-tested</u>		
Purchase	27	0	23	4	13	0	63	94%
Pennyrile	32	0	23	3	3	0	58	95%
Green River	47	1	38	28	9	10	95	71%
Mammoth Cave	56	2	20	2	9	0	85	95%
TOTAL	162	3	104	37	34	10	300	86%

What Was Seed Quality?

The germination percentage for those samples collected ranged from 0 to 97% with a mean germination for all 354 samples of 80.5% (Table 7). More than 70% of the acreage planted in the survey was planted with seed which had germinations exceeding 80%. On the other hand, more than 15% of the acreage planted was with seed having germination percentages of less than 70%. Fifteen samples, representing 1800 acres had germination percentages of less than 50% and 3 samples had no viable seeds.

Table 7. Percent germination of samples and distribution of acreage planted within each viability level.

Germination Percentage	Samples		Acres Planted	
	No.	%	No.	%
90 - 97	103	29.1	11,900	26.6
80 - 89	153	43.2	20,115	44.9
70 - 79	47	13.3	5,480	12.2
60 - 69	22	6.2	3,690	8.2
50 - 59	15	4.2	1,844	4.1
40 - 49	4	1.7	1,401	3.1
30 - 39	6	1.1	287	.6
20 - 29	1	.3	40	.1
10 - 19	0	-	0	-
0 - 9	3	.9	90	.2
TOTAL	354	100.0	44,847	100.0

The germination percentage as related to source of seed is shown on Table 8. There was little difference in total germination percentage for all samples between the certified and non-certified sources. When germination is compared as to source of seed, that seed purchased from seedsmen was approximately 2-3% higher than seed originating from homegrown or neighbor sources. The 69.2% germination of certified seed from neighbor sources is misleading since only 4 samples were tested compared to some 40 non-certified samples of the same origin. It can be observed in Table 8 that the percent purity for all samples tested, regardless of source, was excellent, exceeding 99% in most cases. Even though it is not shown in Table 8, the quality of all samples which were not cleaned prior to planting was considerably lower. Likewise, the germination percentage for all samples which had not been tested was 75% and ranged considerably lower than for those samples which had been tested prior to planting.

Table 8. Average percent purity and germination of samples when compared from three seed sources and for certified and non-certified seed.

	Source			Combined Percent
	Seedsmen	Home Grown	Neighbor	
<u>Percent Purity</u>				
All samples	99.1	99.0	99.1	99.1
Certified	99.4	99.3	99.8	99.4
Non-Certified	98.9	99.0	99.1	98.9
<u>Percent Germination</u>				
All Samples	82.7	80.5	79.4	80.5
Certified	83.1	80.4	69.2	81.5
Non-Certified	82.2	80.5	80.4	80.3

^{1/} Mean germination percentage for all samples = 80.5%

The number of samples having objectionable weeds or corn as related to source of seed are shown in Table 9. It can be observed that 15 samples or 4% of those in the total survey, had corn present at the time of planting. Whereas, 41 samples or approximately 12% of the total had objectionable weeds. It should be noted that nearly all of those samples having either objectionable weeds or corn present, occurred from non-certified sources. In general, those samples occurring from homegrown and neighbor sources have had more corn and objectionable weeds present, which, in some cases, relates to the fact that they were not tested prior to planting.

Table 9. Number of samples having contaminants when compared from three sources and for certified and non-certified seed.

<u>Contaminant</u>	<u>Source</u>			
	<u>Seedsmen</u>	<u>Home Grown</u>	<u>Neighbor</u>	<u>Total</u>
<u>Corn Present</u>				
Certified	1	0	0	1
Non-Certified	$\frac{3}{4}$	$\frac{9}{9}$	$\frac{2}{2}$	$\frac{14}{15}$
Total Samples				
<u>Objectionable Weeds Present</u> ^{1/}				
Certified	2	0	0	2
Non-Certified	$\frac{10}{12}$	$\frac{22}{22}$	$\frac{7}{7}$	$\frac{39}{41}$
Total				

Summary

After examining the results of this survey, the following observations were reached regarding soybean planting seed quality for the areas surveyed in 1973.

1. Farmers generally recognize the importance of adapted and recommended soybean varieties, since the leading varieties which made up 85% of the acreage planted, were all recommended in the state.
2. Approximately 50% of the soybean seed planted was purchased from seedsmen sources, whereas the remainder was secured from either homegrown or neighbor sources. The percentage purchased from seedsmen increased to 66% in the Mammoth Cave Area, but decreased to 35% in the Green River Area.
3. One-third of the samples planted were from certified seed sources. The percentage of certified seed ranged from a low of 20% in the Green River Area, to a high of 44% in the Pennyryle Area. Fifty percent of the seed purchased from seedsmen was certified, whereas a small percentage of the seed from homegrown or neighbor sources was certified.

^{1/} Objectionable weeds includes the occurrence of any of the following; Cocklebur, Johnsongrass, Giant foxtail and Horseweed (Giant ragweed).

4. A high percentage (98%) of the seed had been cleaned prior to planting and most of this cleaning was done in commercial processing plants.
5. Only 85% of the samples planted had been tested for purity and germination prior to planting. Most of these untested samples occurred in the Green River Area, since 95% of those samples planted in the Purchase, Pennyrite, and Mammoth Cave Areas had been tested before planting. Approximately 1/3 of those samples planted from homegrown sources had not been tested.
6. The mean germination percentage for the 354 samples surveyed was 80.5%. More than 70% of the total acreage planted was with seed that germinated higher than 80%. However, extremely low germinations ranging down to 0% were recorded in the survey, especially in some seed lots which had not been tested and/or cleaned prior to planting.
7. The percent purity was excellent for all seed lots in the survey, regardless of origin or area planted.
8. Even though 98% of the samples had been cleaned prior to planting, nearly 12% still contained objectionable weeds. Likewise, 4% of the samples planted contained corn as a contaminant. Nearly all of those samples which contained corn or objectionable weeds were from non-certified origins.

A Note of Appreciation

The author expresses appreciation to the division of Regulatory Services, and Mr. Wayne Still, the head of the seed testing laboratory, for providing his time and the equipment necessary for the purity and germination tests for all samples in this survey. Likewise, appreciation is expressed to the members of Kentucky Seed Improvement Association, for providing the financial assistance necessary to pay those persons taking the samples for the survey. Without such cooperation, a survey such as this would be impossible.