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Better Potatoes — More Money

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ACTUAL potato inspection certificates for 5 years, beginning in 1931, give striking proof that Minnesota potato producers could add materially to their income by giving more attention to quality in three ways:

1. By more careful sorting of potatoes to prevent a few bad ones from lowering the grade on a lot of good ones.

2. By better control of potato diseases that cause grade defects.

3. By careful digging and handling to avoid cuts and bruises.

This bulletin summarizes the facts learned from official certificates covering all potato inspections in Minnesota during five consecutive years. During that time, less than half of all the lots inspected graded U. S. No. 1 or U. S. No. 2, indicating that at least half of all the potatoes sold in the state during that period would have graded below U. S. No. 2.

Here's What Sorting Could Have Done

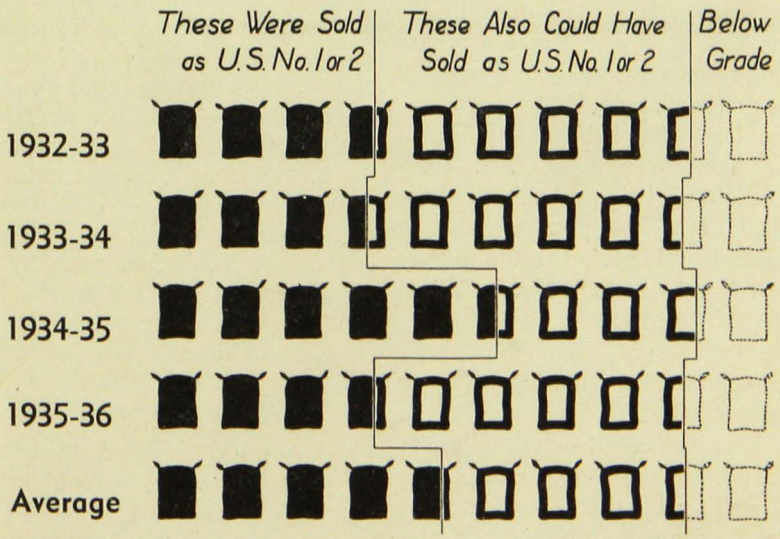

Fig. 1. Each Sack Represents 10 Per Cent of the Year's Crop.

AGRICULTURAL EXTENSION DIVISION—UNIVERSITY OF MINNESOTA

One fact revealed in this study, however, is a real eye opener for every producer. This was the fact that a very large share of the inspected lots falling below U. S. No. 2 actually contained enough good potatoes to grade higher if only a small per cent of the worst potatoes had been sorted out. This is shown by the pictogram on page 1 and is explained on later pages.

Over 21,000 Cars Studied

The Federal-State Inspection Service inspected over 21,000 cars of Minnesota potatoes during the 5-year period 1931-32 to 1935-36. The inspection certificate for each of these cars has been checked for information regarding the grade, condition, variety and size of potatoes in the lot, as well as the extent of the damage from injury, disease, growth conditions and other causes. These inspections cover only part of the potatoes produced in the state, but it is probable that they are fairly representative of the uninspected potatoes as well.

Since less than half of the lots of potatoes inspected graded U. S. No. 1 or U. S. No. 2, it is probable that less than half of all the potatoes sold in Minnesota in this period would qualify as U. S. No. 1 or U. S. No. 2. When potatoes fail to grade U. S. No. 1, U. S. Commercial, or U. S. No. 2, they can not command the market price for these grades and must be sold at a much lower price. Reconditioning at the market is more expensive than careful sorting by the seller. Buyers may take advantage of this fact and buy at a discount much larger than justified by the amount of defects present. The seller then takes this discount besides paying transportation costs on the unsalable potatoes.

Poor Potatoes Overshadow Good

A surprisingly large portion of the lots of inspected potatoes failing to grade U. S. No. 1 or U. S. No. 2 could have qualified for these grades with a little more rigid sorting. What could have been done is shown in Figure 1 on the first page. The solid black sacks are the proportion of potatoes actually passed by the inspectors for U. S. No. 1 or U. S. No. 2. The heavily outlined sacks represent the additional potatoes that could have been sold in these grades if enough of the poorer potatoes had been sorted out. Detailed data are shown in Tables 3 and 4, pages 10 and 11. In 1932-33, only 37 per cent of the lots inspected graded U. S. No. 1 and U. S. No. 2 altho 87 per cent of the potatoes could have made these grades if sorted. Likewise, sorting could have increased the percentages in these grades from 34 per cent in 1934-35 to 84 per cent, and from 38 per cent in 1935-36 to 86 per cent. Obviously, more careful sorting during these years would have raised the grade on a large proportion of the potatoes. This undoubtedly would have brought a better price per bushel and very likely a greater gross income to the producer.

Factors Lowering Grade

Potatoes grade lower because of defects and, to some extent, because of size. Consideration of all defects is included in this study, attention being given first to defects such as bruises, cuts, scabs, etc., which inspectors listed

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for lots failing to meet specified grade requirements, but did not list for lots meeting grade requirements. Hollow heart, soft rot, and size, which were listed on all certificates, are considered separately.

that Minnesota growers could greatly improve the quality of potatoes marketed by more careful digging and handling. These defects were reported in every district throughout the state and were high in every year.

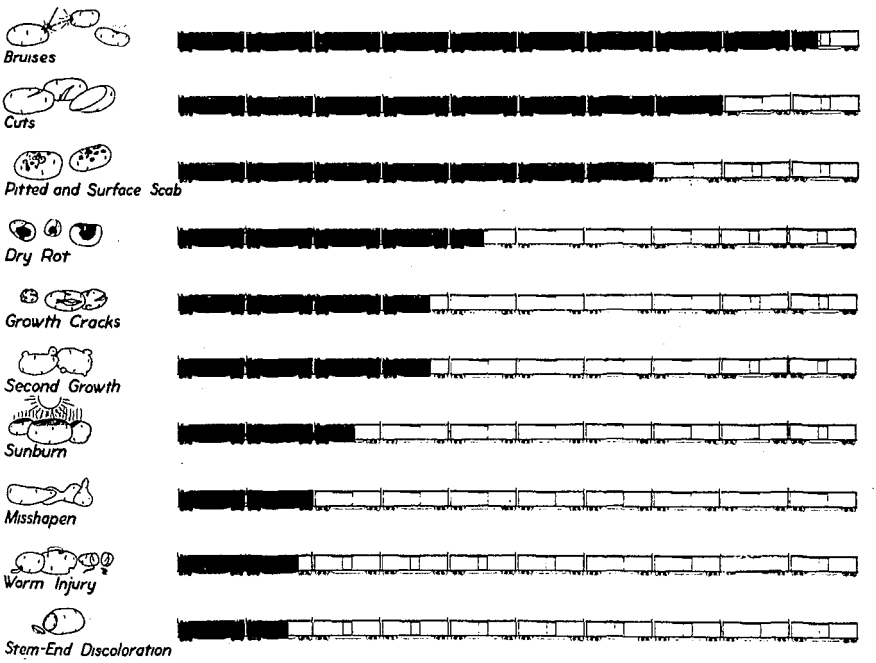


Fig. 2. Proportion of Lots Showing Specified Defects.

Defects[1]

The ten most frequently mentioned defects and the proportion of the lots in which they were reported are shown in Figure 2. The most frequently mentioned of all the defects are cuts and bruises, cuts appearing in 79 per cent of all the lots over the 5-year period and bruises in 94 per cent. Cuts and bruises occur when digging, and additional bruises may be caused by rough handling later. This would indicate

The other defects result largely from disease and growth conditions over which the grower has less control. The prevalence of these defects varies considerably in different years and different sections of the state. The extent of this variation may be judged from some of the area tables presented later in this discussion. Table 1 shows the percentages of defects by crop years for the state as a whole.

In making out their inspection certificates, potato inspectors list the de-

[1] A description of these defects will be found in Minnesota Special Bulletin 182, Potato Pointers.

Table 1. Percentage of Times Specified Defects Were Mentioned in Lots Failing to Grade U. S. No. 2 or Better

	1931-32	1932-33	1933-34	1934-35	1935-36	Five-year average
	per cent	per cent	per cent	per cent	per cent	per cent
Bruises	88	93	95	93	97	94
Cuts	66	81	82	74	77	79
Pitted and surface scab	57	87	65	74	54	69
Dry rot	29	53	49	28	40	45
Growth cracks	37	44	35	29	37	37
Second growth	40	44	34	41	31	37
Sunburn	28	22	37	21	14	26
Stem-end discoloration	17	14	17	19	14	16
Misshapen	17	7	27	23	26	21
Worm injury	20	21	21	15	12	18

fects in the order of their importance. Therefore, the certificates show the relative importance of the various classes of defects found in the major varieties and in potatoes from the different districts of the state. This was ascertained by recording the number of times each defect was mentioned and noting the order in which the inspector ranked it.

In Figure 3 the defects mentioned first and second have been grouped as the more important and those mentioned later are considered the less important. The defects have been grouped in the following four classes: (1) Mechanical injuries, which include the damage caused by handling and marketing, such as cuts and bruises, (2) diseases, which include scab, dry rot, stem-end discoloration, etc., (3) growth conditions, which are due largely to weather and include such things as growth cracks, misshapen potatoes, second growth, etc., and (4) miscellaneous items, such as freezing, sunburn and worm injury. Detailed data are shown in Table 5, page 12.

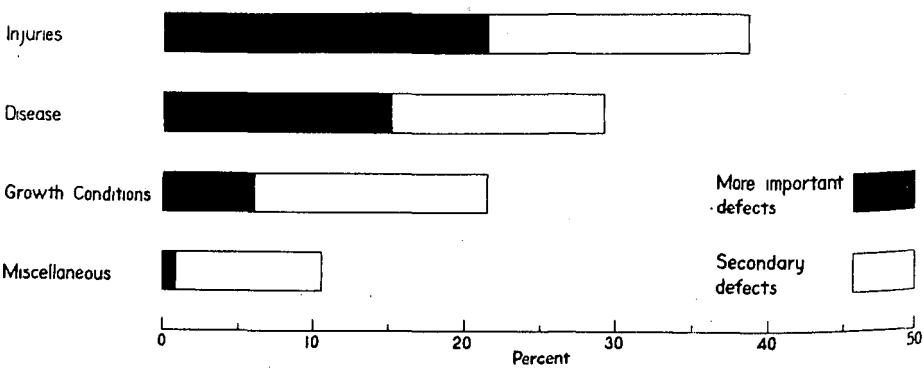


Fig. 3. Relative Importance of Classes of Defects.

The inspection certificates for all districts listed cuts and bruises more frequently for Cobblers than for Ohios. Moreover, these defects were more often mentioned in first and second place in Cobblers than in Ohios. Diseases were also more prevalent in Cobblers, but the difference was less marked, both in total times mentioned and in times mentioned in first and second place, except in the Northeast area where the Ohio inspections were few. With the exception of hollow heart, defects resulting from growth conditions are mentioned more frequently in Ohios than in Cobblers. Miscellaneous items show no consistent differences.

Hollow heart, soft rot and size also may contribute to a lowering of the grade. As pointed out before, these are presented separately in this report since they are specifically mentioned on all inspection certificates, and the extent of damage is estimated separately.

Hollow Heart

This defect is reported almost exclusively in Cobbler and other round white varieties. It is caused by growth conditions and varies considerably in different years and in different sections of the state.

Heaviest damage to Cobblers was found in 1935-36 when 20 per cent of all Cobblers inspected showed some hollow heart. Potatoes from the Red River Valley district were affected the most. There was considerable damage in Freeborn County (Hollandale) in 1933-34 and in the Sandland area in 1934-35. However, the per cent of damage in the state as a whole was slight during these two seasons. No damage was reported in 1931-32 and 1932-33.

Table 2. Proportion of Lots of Minnesota Inspected Potatoes Showing Specified Percentages of Soft Rot Damage, Crop Years 1931-32 to 1935-36

	1931-32	1932-33	1933-34	1934-35	1935-36	Five-year average
	per cent	per cent	per cent	per cent	per cent	per cent
Lots showing over one per cent	1	1	2	1	3	1
Lots showing one per cent or less	2	18	23	17	40	21
Lots showing no soft rot	97	81	75	82	57	78
Total	100	100	100	100	100	100

Soft Rot

This term includes any soft, mushy or leaky condition of the tissue, as slimy soft rot, leak or wet breakdown, following injury from freezing or sunscald. When present, it is a very serious defect and not over one per cent is allowed in U. S. No. 1 potatoes. Cars having more than one per cent soft rot would fail to grade U. S. No. 1 even though no other defects were present. Table 2 shows the percentage of soft rot found.

Soft rot damage was most severe in 1935-36 when 43 per cent of the in-

spected potatoes showed this defect. The lowest proportion reported was in 1931-32.

Size of Potatoes

The smallest size allowed in U. S. No. 1 potatoes is one and seven-eighths inches in diameter and not more than 5 per cent may be below that minimum. In determining the quality of potatoes in a car, the percentage of potatoes below the minimum size is added to the percentage of defects found. For example, a car which has 10 per cent defects and 10 per cent below one and seven-eighths inches would be graded 80 per cent U. S. No. 1 quality.

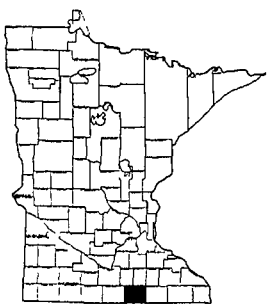
Other minimum sizes are permitted and when a car of potatoes meets all other requirements, it may be graded "U. S. No. 1—one and one-half inches minimum," or "U. S. No. 1—one and three-fourths inches minimum," but when no minimum size is designated, it is assumed to be "U. S. No. 1—one and seven-eighths inches minimum."[2]

Changes made in methods of inspecting size would make it difficult to compare potatoes for different years. It is likewise difficult to make a comparison between districts because of the difference in varieties grown.

The Cobbler and other round white potatoes in most samples measured from two and one-fourth inches to two and three-fourths inches, the Triumph from two inches to two and one-half inches, and the Ohio from three or four ounces up to eight ounces. Considerable variation in size in different years was noted in the Ohio, but little or none among round varieties.

IMPORTANT SHIPPING AREAS IN THE STATE

Hollandale Area



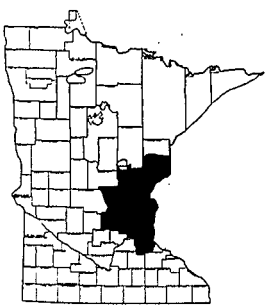
	High year (per cent)	Low year (per cent)	5-year average (per cent)
Potatoes grading U. S. No. 2 or above	88	40	61
Proportion of lots grading below U. S. No. 2 showing the following defects:			
Bruises	95	89	92
Cuts	95	64	75
Pitted and surface scab	71	42	62
Stem-end discoloration	74	30	45
Worm injury	52	23	33

From 38 per cent to 60 per cent of all potatoes produced in this county were shipped in carlots. In 1932 only a small percentage was inspected, but in

[2] In this study, no distinction has been made between minimum sizes in those potatoes which graded U. S. No. 1; they are termed U. S. No. 1 regardless of minimum size. On the potatoes which failed to grade U. S. No. 1, the one and seven-eighths inch minimum was used in determining the percentage of the U. S. No. 1 quality in the car.

other years over 60 per cent of all carlots were inspected. It is difficult to make a comparison between this district and the state, because Hollandale markets its potatoes much earlier than the state as a whole, and also because only one type of potato is grown, namely, the Cobbler. However, with the exception of 1934-35, the quality of inspected potatoes from Freeborn County was equal to or higher than the state average. In most cases defects were mentioned less frequently than for the state as a whole, with the exception of stem-end discoloration which seems to be very serious in this district. More worm injury is reported than for the state as a whole.

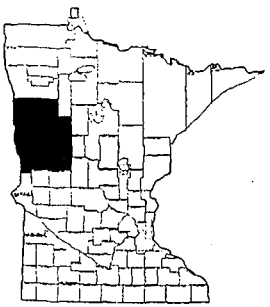
Sandland Area



	High year (per cent)	Low year (per cent)	5-year average (per cent)
Potatoes grading U. S. No. 2 or above	49	5	14
Proportion of lots grading below U. S. No. 2 showing the following defects:			
Pitted and surface scab	97	89	94
Bruises	98	83	92
Cuts	88	61	84
Second growth	54	40	47
Growth cracks	48	29	41
Dry rot	45	3	33

About 25 to 30 per cent of the potatoes produced in this area are shipped in carlots and from 28 to 47 per cent of these were inspected. Since many potatoes are trucked to the Minneapolis-St. Paul market and are not inspected, the inspections do not fully indicate the quality of the potatoes grown. In the analysis of those potatoes which failed to grade U. S. No. 2 or better, it was found that, for the 5-year period, 57 per cent graded 80 per cent U. S. No. 1 or better, indicating that by more careful sorting a much larger percentage of U. S. No. 1 potatoes could be obtained. However, since potatoes from this district are sold largely on the city market, growers are probably penalized less than they otherwise would be for not conforming to the state and federal grades more closely. It will be noted that the percentage of lots showing pitted and surface scab is much greater than the state average, also that there is a larger percentage of cuts, second growth and growth cracks. Other defects are reported in about the same proportion as the state average. From the lower score given the potatoes, it may be assumed that these defects when present are more serious than in other areas.

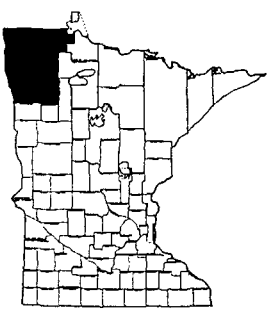
South Red River Valley Area



	High year (per cent)	Low year (per cent)	5-year average (per cent)
Potatoes grading U. S. No. 2 or above	90	19	54
Proportion of lots grading below U. S. No. 2 showing the following defects:			
Bruises	99	90	97
Cuts	86	55	76
Pitted and surface scab	68	52	59
Dry rot	95	34	59
Growth cracks	63	28	39
Second growth	61	31	35

Carlot shipments represented from 56 to 87 per cent of the production in this area and from 22 to 36 per cent of these carlots were inspected. Inspections should be quite representative of the potatoes grown in the area. In 1931-32, 1932-33 and 1933-34 the percentage of potatoes grading U. S. No. 2 or better was considerably higher than for the state as a whole, while in the next two years it was considerably lower. In 1934-35 and 1935-36 there was considerable damage caused by soft rot and wet breakdown following freezing injury. In most cases the percentage of times the various defects were mentioned corresponds closely to the state averages. In this area, pitted and surface scab are less prevalent each year than in the rest of the state, while dry rot is more common. The greater amount of dry rot probably can be attributed to late marketing of potatoes.

North Red River Valley Area



	High year (per cent)	Low year (per cent)	5-year average (per cent)
Potatoes grading U. S. No. 2 or above	94	65	76
Proportion of lots grading below U. S. No. 2 showing the following defects:			
Bruises	98	96	98
Cuts	82	47	77
Misshapen	73	4	58
Dry rot	65	33	51
Growth cracks	44	28	40
Sunburn	40	6	33

In this area from 49 to 74 per cent of the potatoes produced were shipped in carlots. Inspections varied from 21 per cent to 58 per cent of carlot shipments. Bruises were present in almost every lot that failed to grade, the percentage being higher every year than the state average. The percentage of misshapen potatoes was much larger than the state average. Stem-end discoloration is practically unknown in this district and pitted and surface scab was mentioned in only 20 per cent of the lots for the 5-year period.

Northeast Area

Potatoes are an important source of income in this area. The number of cars of potatoes inspected from this district, however, was such a small proportion of the potatoes shipped during these years that the sample was considered inadequate to present a true picture of the quality. The limited sample showed 81 per cent of the potatoes grading U. S. No. 2 or better

SUMMARY

The grower is naturally interested in how the grade of his potatoes may be raised. It is clear from the preceding discussion that the methods open to him are:

1. **More careful sorting of potatoes as they are now produced and handled.**

2. **Reducing the defects by more care in cultural methods and handling.**

The most striking point brought out is the extent to which mechanical defects lower the grade of Minnesota potatoes. In nearly every lot which failed to grade U. S. No. 1 or U. S. No. 2, mechanical injury was an important contributing factor. This is significant since such injuries are subject to considerable control. Beyond a doubt, Minnesota growers and handlers could greatly improve the quality of potatoes marketed by greater attention to digging and handling.

The next most damaging defects were diseases. These also are subject to some control through seed selection, seed treatment and better cultural practices. It seems certain that farmers would be more than repaid for controlling these defects because of the higher price they would receive for a better quality of potatoes.

Table 3. Grades of Inspected Minnesota Potatoes, Crop Years 1931-32 to 1935-36

Crop year August to July	Minnesota certified seed	Proportion grading U. S. No. 1 or U. S. No. 2	Proportion failing to meet requirements of U. S. No. 1, U. S. No. 2, or Minnesota certified seed grades					Total inspection
			Lots with over 80% U. S. No. 1 potatoes	Lots with 60-78% U. S. No. 1 potatoes	Lots with 40-58% U. S. No. 1 potatoes	Lots with 5-38% U. S. No. 1 potatoes	Lots of unknown grade	
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
1931-32	1.6	86.4	10.5	1.2	.1	0.0	.2	100.0
1932-33	0.0	37.2	53.3	8.8	.5	.1	.1	100.0
1933-34	0.0	34.1	44.5	15.9	3.1	1.8	.6	100.0
1934-35	9.2	55.3	21.9	9.9	1.3	.2	2.2	100.0
1935-36	14.5	37.6	33.2	9.5	1.2	.9	3.1	100.0
5-year average	4.5	48.2	34.3	10.1	1.1	.6	1.2	100.0

Table 4. Proportion of Minnesota Potatoes Grading U. S. No. 1 or U. S. No. 2. Also Proportion of U. S. No. 1 and U. S. No. 2 Potatoes Found in All Lots*

Crop years	Freeborn County (Hollandale)		Sandland		South Red River Valley		North Red River Valley		Northeast		State	
	Per cent grading U. S. No. 1 or No. 2	Per cent U. S. No. 1 or No. 2 in all lots	Per cent grading U. S. No. 1 or No. 2	Per cent U. S. No. 1 or No. 2 in all lots	Per cent grading U. S. No. 1 or No. 2	Per cent U. S. No. 1 or No. 2 in all lots	Per cent grading U. S. No. 1 or No. 2	Per cent U. S. No. 1 or No. 2 in all lots	Per cent grading U. S. No. 1 or No. 2	Per cent U. S. No. 1 or No. 2 in all lots	Per cent grading U. S. No. 1 or No. 2	Per cent U. S. No. 1 or No. 2 in all lots
1931-32	85.69	92.75	44.86	87.78	88.87	93.21	90.63	93.40	89.84	93.33	86.36	92.89
1932-33	39.71	86.54	5.42	83.60	75.30	92.40	78.08	92.24	73.68	92.37	37.18	87.50
1933-34	52.06	88.21	11.07	77.23	18.51	82.69	64.65	89.03	60.77	88.73	34.03	84.00
1934-35	42.72	88.68	7.13	75.70	59.70	90.27	76.64	92.65	53.70	92.72	55.27	88.57
1935-36	44.28	87.38	13.38	78.38	29.42	86.09	52.52	89.13	32.02	90.25	37.61	86.50
5-year average	59.12	89.46	9.40	80.89	51.77	88.41	68.56	90.77	71.05	91.63	48.14	87.49

* Certified Seed is not included. For this reason the percentages differ from those in the text which include Certified Seed.

Table 5. Classification of Defects of Inspected Minnesota Potatoes Which Failed to Grade U. S. No. 1, Average of Crop Years 1931-32 to 1935-36

District	Variety	Injuries		Disease		Growth conditions		Miscellaneous		Per cent total
		Mentioned as an important defect	Mentioned as a secondary defect	Mentioned as an important defect	Mentioned as a secondary defect	Mentioned as an important defect	Mentioned as a secondary defect	Mentioned as an important defect	Mentioned as a secondary defect	
		Per cent of all defects		Per cent of all defects		Per cent of all defects		Per cent of all defects		
	Cobbler	23.6	15.8	18.9	14.2	1.6	12.8	2.3	10.8	100.0
Hollandale (Freeborn Co.)	Ohio	18.4	10.5	13.2	15.8	10.5	13.2	2.6	15.8	100.0
	Cobbler	21.6	19.5	21.4	11.4	1.5	18.6	.5	5.5	100.0
Sandland	Ohio	9.3	22.8	19.5	8.0	10.7	20.8	1.1	7.8	100.0
	Cobbler	43.3	6.7	16.7	23.3	0	3.3	0	6.7	100.0
Northeast	Ohio	13.3	13.3	20.0	0	6.7	40.0	0	6.7	100.0
	Cobbler	34.8	12.5	6.4	10.0	9.2	10.9	.7	15.1	100.0
North Red River Valley	Ohio	25.9	12.7	4.2	10.1	13.2	22.7	.5	10.7	100.0
	Cobbler	33.1	15.1	18.3	20.3	.5	3.9	.7	8.1	100.0
South Red River Valley	Ohio	14.3	19.2	10.8	18.0	14.8	17.5	.3	5.1	100.0
	Cobbler	29.2	15.8	17.3	15.9	2.2	9.6	.9	9.1	100.0
State	Ohio	15.0	19.0	12.0	13.7	13.4	19.4	.6	6.9	100.0
	All	21.5	17.2	15.1	14.1	6.1	15.4	.9	9.7	100.0

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