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Cropping systems : kind, intensity, and length

G. E. Toben

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CROPPING SYSTEMS—

Kind, Intensity, and Length

**West Virginia University
Agricultural Experiment Station**

**Bulletin 530
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WEST VIRGINIA UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
COLLEGE OF AGRICULTURE AND FORESTRY
A. H. VANLANDINGHAM, DIRECTOR
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SUMMARY

The study reported in this bulletin was concerned with cropping systems, forage seedings, length of forage stands, and volunteer seeding. Data were obtained in the section of the Appalachian Valley which has soils derived from acid, sandstone, shale, and some soils with limestone influence. These vary from shallow to deep.

Details were obtained from 54 dairy farms, 357 fields, and on 38 soil series that were evaluated in 16 different soil groups. Farms averaged more than 400 acres in size, with 18 per cent in cropland, 26 per cent in open permanent pasture, 55 per cent in woodland and woodland pasture, and 1 per cent in other uses. Cropland averaged 27 per cent in cultivated crops, 18 per cent in small grains, and 55 per cent in hay crops. On the third of the farms with the least cropland, the rotations approximated one cultivated crop, one small grain crop, and three years of hay. On the third of the farms with the most cropland, the rotations were lengthened one year by including two years of a cultivated crop.

Corn was the principal cultivated crop. Oats, barley, and wheat were the small grain crops, with spring and winter grains representing similar proportions. Alfalfa was the principal hay crop, appearing more often as a single seeding than other single seedings and appearing more frequently in mixtures than other seedings. Timothy was the principal grass seeding.

Cultivated crops occurred in the rotations in 75 per cent of the fields. Small grains occurred in 82 per cent of the fields, and hay was included in 92 per cent of the rotations. Of all fields in hay, 17 per cent remained in hay for only one year, while only 14 per cent of the fields continued in hay for more than six years.

About 60 per cent of the fields planted to corn had slopes of 3 per cent and less. None of the fields with slopes in excess of 20 per cent were in corn.

Relatively level fields were in hay for a shorter length of time than those on steeper slopes. One-third of the fields with slopes of 3 per cent and less were in hay for a single year, but 97 per cent of the fields with slopes over 3 per cent remained in hay more than one year.

Fields seeded with alfalfa, clovers, or timothy showed a decrease in the proportion of the seeding with increased age of stand. Bluegrass was most important, and orchardgrass was second in importance as the volunteer crop that replaced the seeding that ran out.

CROPPING SYSTEMS— Kind, Intensity, and Length

**G. E. TOBEN, P. E. NESSELROAD, J. L. MORRIS,
AND G. G. POHLMAN**

Cropping systems are important; they influence the kinds, quantities, and qualities of feed produced. This feed, in turn, affects the number and production of livestock. Consequently, the cropping systems have an influence on farm income.

This bulletin reports the crops grown on different sizes of dairy farms, rotations on different land classes, lengths of rotations, seedings used, extent of run-out in hay-type crops, and native seedings coming into forages.¹

Most information used in this publication was obtained from farmers who had at least 10 dairy cows, had operated the same farm at least four years, and were less than 65 years of age. Information was obtained about each rotation field containing two or more acres and having 75 per cent or more of the soil of one similar soil group. The farmer could remember what crops were grown during the last complete rotation.

DESCRIPTION OF THE AREA

Farms used in this research are located in the West Virginia counties of Mineral, Hampshire, Grant, and Hardy. These counties are located in part of an area described as the Juniata-Potomac section of the Northern Appalachian Ridges and Valleys. The Juniata-Potomac section also includes all or parts of 14 counties in South Central Pennsylvania, Alleghany and Washington counties in Maryland, and Frederick and Highland counties in Virginia (Map 1).

LAND USE

The farms used in this study were classified into three groups on the basis of cropland acreage. These groups are identified and hereafter referred to as small, medium, and large farms. The cropland included all

¹This report is part of a research investigation of forage production. The research was partially supported by NE-43 funds made possible by the Research and Marketing Act of 1946.

MAP I

MAP OF WEST VIRGINIA, FOUR-COUNTY AREA STUDIED, AND JUNIATA-POTOMAC SECTION OF APPALACHIAN VALLEY

Solid lines border West Virginia.

Broken lines separate the four-county area where the study was conducted.

Heavy shading identifies the Juniata-Potomac Section of the Northern Appalachian Ridges and Valleys.*

Light shading shows the area of the four counties where farms are located.

Map traced from:

Patrick, Austin L., *Problem Areas in Soil Conservation, Northeastern Region*, USDA, SCS, June 1951

**Atlas of River Basins of the United States*, USDA, SCS, Washington 25, D.C., June 1963.

land in cultivated crops, close grown crops, hay-type crops, and land temporarily idle from such crops.

The cropland acreage per farm varied from a low of 19 to a high of 215 acres. The cropland acreage in the large farms was more than three times greater than the acreage in the small farms (Table 1). The largest farms had more than twice the cropland acreage than the medium-sized farms had.

On the smallest-sized farms, the cropland averaged 14 per cent of the land area in the farms (Table 2). On the other two groups the cropland averaged 20 per cent of the land. In all three groups the acreage in open permanent pasture exceeded that in cropland. The woodland acreage averaged 50 per cent or more of the land in farms.

In all three groups of farms, the acreage in close grown crops was about 18 per cent of the rotation land. As the acreage in small grains in-

TABLE 1

Acreage of crops per farm on 54 small, medium, and large dairy farms, Appalachian Valley, West Virginia, 1959.

Crop	Relative Acreage of Cropland ¹		
	Small	Medium	Large
	<i>Acreage</i>		
Corn grain	2	4	14
Corn silage	6	7	22
Other cultivated silage crops ²	0	2	3
ALL CULTIVATED CROPS	8	13	39
Oats—spring grain	3	3	7
Barley—winter grain	0	3	7
Wheat—winter grain	2	2	3
Rye or other mixed grains	-	0	1
Oats—spring hay or silage	1	1	2
Oats and barley—winter seeding for hay or silage	-	-	-
Sorghum, soybeans, and sudan drilled for silage	1	2	-
Rye, oats, or sudan pastured	0	1	2
ALL CLOSE CROWN	7	12	23
Alfalfa	4	2	9
Alfalfa with other forages	11	21	25
Other legumes, no alfalfa	1	-	5
Legumes and grasses, no alfalfa	5	8	12
Biennial and perennial grasses	1	3	4
Biennial and perennial pastured	2	2	7
ALL HAY TYPE CROPS	24	36	62
Idle cropland	0	1	2
ALL CROPLAND	39	62	126
Open permanent pasture	68	89	162
Woodland and woodland pasture	172	156	347
Farmstead, roads, and waste	6	5	6
TOTAL FARM ACREAGE	285	312	641

¹A dash (-) designates no acreage. A zero (0) designates less than one-half acre.

²Mixed seedings with corn, sorghum, soybeans, or sudan.

TABLE 2

Proportion of land in selected uses on 54 small, medium, and large dairy farms, Appalachian Valley, West Virginia, 1959.

Crop	Relative Acreage of Cropland		
	Small	Medium	Large
	<i>Per cent</i>		
Per cent of farm in:			
Cropland	14	20	20
Open permanent pasture	24	28	25
Woodland	60	50	54
Farmstead, road, and waste	2	2	1
ALL FARM LAND	100	100	100
Per cent of cropland in:			
Cultivated crops	20	21	31
Close grown crops	18	19	18
Hay	62	58	49
Idle	0	2	2
ALL CROPLAND	100	100	100

creased, the proportion of winter grains increased from 29 per cent on the smallest farms to 48 per cent on the largest farms.

As the cropland acreage increased, the proportion in cultivated crops increased from 20 per cent on the smallest farms to 31 per cent on the largest farms. The proportion of the cultivated crops in corn grain also increased from 25 to 36 per cent of the cultivated acreage between the smallest and the largest farms. Cultivated crops other than corn were relatively unimportant. Those which were grown for silage included sorghum, soybeans, and sudan. These were grown singularly and in mixtures with and without corn.

The increase in the proportion of cultivated crops was offset with a proportional decrease in hay-type crops as the acreage of cropland increased. Hay acreage was 62 per cent of the cropland on the smallest farms but only 49 per cent on the largest farms. Alfalfa and alfalfa mixtures were the dominant crops, accounting for more than 50 per cent of the hay-land acreage on all-sized farms. On the largest farms, the acreage in alfalfa and alfalfa mixture was exceeded by the acreage in corn.

The cropland averaged 75 acres per farm for all farms. Of this, 26 per cent was in cultivated crops, 18 per cent in small grains, and 56 per cent in hay-type crops.

The crop rotation on the small and medium farms was approximately the same. In both groups it was nearly the equivalent of a rotation of one year of corn, one year of small grains, and three years of hay.

On the largest farms, cultivated crops were relatively more important. The rotation approximated two years of corn, one year of small grain, and three years of hay.

PROPORTION OF FARMERS GROWING CROPS

Some differences occurred in the proportion of farmers in the different-sized groups who grew selected crops (Table 3). There were twice as many farmers growing corn grain on the largest, as compared with the smallest, farms. On the smallest farms, 39 per cent produced corn grain; whereas, 78 per cent of those with the largest farms raised corn. Relative increases also occurred with corn silage. When all cultivated crops were considered as a group, small differences occurred among sizes of farms. More than 80 per cent in each group raised cultivated crops, the majority of which was corn for silage or grain.

Fewer farmers with small and medium farms raised small grains than grew cultivated crops. However, the same proportion of farmers with the largest farms grew small grains and corn.

In all groups, a larger proportion of farmers produced spring oats for grain than produced either winter barley or winter wheat. The principal difference between groups in the production of the three major small grain crops occurred with winter grains. A smaller proportion of the smallest farms grew winter barley; whereas, a smaller proportion of the medium and largest farms grew winter wheat for grain.

All farmers produced biennial or perennial hay-type crops. However, no crop or mixture of crops was produced by all farmers. Mixtures with alfalfa in the seeding were most important. Alfalfa was produced by more than 80 per cent of the farmers in each group. No other hay crop occurred with greater frequency.

TABLE 3

Proportion of farmers growing selected crops, 54 small, medium, and large dairy farms, Appalachian Valley, West Virginia, 1959.

Crop	Relative Acreage of Cropland		
	Small	Medium	Large
	<i>Per cent of Farmers</i>		
Corn grain	39	61	78
Corn silage	67	83	89
ALL CULTIVATED CROPS	83	94	89
Oats—spring grain	44	50	50
Barley—winter grain	11	44	44
Wheat—winter grain	39	22	22
ALL CLOSE GROWN CROPS	67	83	89
Alfalfa alone	39	33	61
Alfalfa with other forages	83	83	89
Legumes and grasses, no alfalfa	39	61	56
Biennial and perennial grasses	22	22	28
ALL HAY-TYPE CROPS	100	100	100

CROPLAND SOILS

The cropland on the farms studied had 38 different soil series according to the classifications on maps prepared by the Soil Conservation Service (Table 4).² These soil series were grouped before field comparison.

²Copies of soil maps for each farm were obtained from county offices of the Soil Conservation Service.

TABLE 4

Soil grouping based on depth, position, drainage, and parent material for soil on 54 dairy farms, Appalachian Valley, West Virginia.

Soil Group	Depth ¹	Position ²	Drainage ³	Parent Material
1 Weikert (Ashby)	S	U	W	Shale
Rushtown	S	T	W	Shale
2 Lebew	S	U	W	Sandstone
Calvin	S	U	W	Shale
Weikert (Ashby)	S	U	W	Shale
3 Corydon	S	U	W	Limestone
Edom	S	U	W	Limestone
4 Litz	S	U	W	Shale and Limestone
Gilpin	S	U	W	Shale
5 Huntington	D	B	W	Shale and Limestone
Ashton	D	HB	W	Shale and Limestone
6 Pope	D	B	W	Shale and Sandstone
Cacapon	D	B	W	Shale and Sandstone
7 Holston	D	T	W	Shale and Sandstone
Juniata	D	T	W	Shale and Sandstone
Ungers	D	U	W	Shale
8 Brookside	D	C	W	Shale and Limestone
Ryder	D	U	W	Shale
Huntington, local	D	C	W	Limestone
9 Laidig	D	C	W	Sandstone
Shelocta	D	C	W	Shale
10 Lindsie	D	B	M	Shale and Limestone
Clarksburg	D	C	M	Shale and Limestone
Captina	D	T	M	Limestone
11 Philo	D	B	M	Sandstone and Shale
Buchanan	D	C	M	Shale and Sandstone
Ernest	D	C	M	Shale
12 Atkins	D	B	P	Shale and Sandstone
Melvin	D	B	P	Shale and Limestone
13 Tyler	D	T	S	Shale
Brinkerton	D	C	S	Shale
Andover	D	C	P	Shale and Sandstone
14 Monongahela	D	T	M	Shale and Sandstone
Cookport	D	U	M	Clay
15 Purdy	D	T	P	Shale
Hollywood	D	C	VP	Shale and Sandstone
16 Alluvial land	D	O	W	Overflow

¹ Depth	² Position	³ Drainage
S—Shallow	HB—High bottom	W—Well
D—Deep	B—Bottom	M—Moderately well
	U—Upland	S—Somewhat poor
		P—Poor
		VP—Very poor

sons were made. Sixteen groupings were made for the analysis dealing with rotations. These groupings were based on characteristics of depth, position, drainage, and parent material. Further combinations were made for the analysis dealing with run-out and native seeding in hay-type crops.

Only those fields with a minimum size of two acres, and 75 per cent of the land in one of the 16 soil groupings, were included in the analysis. This provided 357 fields from the 54 farms. Fifty-three fields with two acres or more were excluded because of soil differences within fields.

CULTIVATED CROPS

Cultivated crops were included in 75 per cent of the rotations (Table 5). The proportion of fields with cultivated crops varied with soil conditions, particular location, depth, and drainage. Cultivated crops oc-

TABLE 5

Per cent of fields by major classes of crops in a rotation, by soil groups, 54 dairy farmers, 357 fields, Appalachian Valley, West Virginia.

Soil Group	Number of Fields	Per cent of Fields by Classes of Crops in Rotation		
		Cultivated Crops	Small Grain Crops	Hay Type Crops
1 Weikert (Ashby), Rushtown	34	68	79	100
2 Lehw, Calvin, Weikert (Ashby)	23	52	57	100
3 Corydon, Edom	4	25	75	100
4 Litz, Gilpin	34	56	91	94
5 Huntington, Ashton	90	93	81	83
6 Pope, Cacapon	20	65	70	90
7 Holston, Juniata, Ungers	10	70	90	100
8 Brookside, Ryder, Huntington, local	5	40	60	100
9 Laidig, Shelocta	14	93	100	100
10 Lindsid, Clarksburg, Captina	45	67	93	98
11 Philo, Buchanan, Ernest	26	73	88	100
12 Atkins, Melvin	10	90	90	90
13 Tyler, Brinkerton, Andover	17	88	94	94
14 Monongahela, Cookport	17	77	82	100
15 Purdy, Hollywood	2	100	100	100
16 Alluvial land	6	100	17	17
ALL	357	75	82	92

curred in all fields with alluvial land, which is deep soil subject to annual overflow of water.

Cultivated crops occurred in 81 per cent of all fields having deep soils not subject to regular overflow (soil groups 5 through 15). They were in 86 per cent of the fields with a deep, well-drained soil (soil groups 5 through 9). They were in 75 per cent of the fields with a deep, but not well-drained soil (soil groups 10 through 15).

Shallow soils had a lower proportion of cultivated crops. Only 58 per cent of them had cultivated crops (soil groups 1 through 4).

Years of Cultivated Crops in a Rotation

Half of all fields had a cultivated crop for one year during the last rotation (Table 6). Thirteen per cent of all fields had cultivated crops for two consecutive years. A few had these crops for three, four or five years. The remaining five per cent had been cultivated each year for 10 or more years.

On the deep soils which are subject to annual overflow, the usual practice was to grow a cultivated crop each year. Corn had been grown

TABLE 6

Proportion of fields by number of years of continuous cultivated crops in a rotation, by soil groups, 54 dairy farms, 357 fields, Appalachian Valley, West Virginia.

Soil Group	Fields by Years of Cultivated Crops						
	None	1	2	3	4	5	10 or More
	<i>Per cent</i>						
1 Weikert (Ashby), Rushtown . . .	32	62	6				
2 Lebew, Calvin, Weikert (Ashby)	48	52					
3 Corydon, Edom	75	25					
4 Litz, Gilpin	44	47	9				
5 Huntington, Ashton	7	37	31	11	1		13
6 Pope, Cacapon	35	40	15				10
7 Holston, Juniata, Ungers	30	70					
8 Brookside, Ryder, Huntington, local	60	20	20				
9 Laidig, Shelocta	7	93					
10 Lindsie, Clarksburg, Captina	33	57	5			5	
11 Philo, Buchanan, Ernest	27	61	4	8			
12 Atkins, Melvin	10	70	10	10			
13 Tyler, Brinkerton, Andover . . .	12	47	35			6	
14 Monongahela, Cookport	23	65		6	6		
15 Purdy, Hollywood		100					
16 Alluvial land		17					83
ALL	25	51	13	4	1	1	5

TABLE 7

Kinds and combinations of crops which were cultivated, 268 fields, 54 dairy farms, Appalachian Valley, West Virginia.

Crops Cultivated	Per Cent of Fields
Corn	89.7
Soybeans	1.2
Truck	.7
Sorghum and soybeans	2.7
Sorghum, soybeans, and sudan	2.2
Sorghum and sudan	1.5
Sorghum and corn	.5
Soybeans and sudan	1.5
	100.0

for ten or more consecutive years on 83 per cent of these fields (soil group 16).

Other than the soils subject to annual overflow, the only soils on which cultivated crops were grown for more than five continuous years were soils that were deep and well-drained. In all the fields with deep, well-drained bottomland soils (soil groups 5 and 6) that had a cultivated crop, 48 per cent had a cultivated crop for two or more years.

Shallow soils seldom had a cultivated crop for more than one year in a rotation. Only five per cent of all these soils (soil groups 1 through 4) had cultivated crops for two consecutive years. Except in unusual circumstances, one year in a rotation cycle is all the cultivation these soils should receive.

Kinds of Cultivated Crops

Corn is the principal cultivated crop (Table 7). It occurred in 90 per cent of the rotations that included a cultivated crop. Most of the other cultivated crops were grain in mixtures harvested for silage.

SMALL GRAIN CROPS

Small grain crops were included in 82 per cent of the rotations (Table 5). They were a regular part of most rotations in each soil group except the alluvial land that is subject to annual overflow (soil group 16).

Years of Small Grain Crops in a Rotation

Small grains were seldom grown more than one year during a rotation (Table 8). Only one per cent of the fields had small grains for two or more consecutive years.

TABLE 8

Proportion of fields by number of years of continuous small grain in a rotation, by soil groups, 54 dairy farms, 357 fields, Appalachian Valley, West Virginia.

Soil Group	Number of Fields	Fields by Years of Continuous Small Grain			
		None	1	2	3
Per cent of Fields					
1 Weikert (Ashby), Rushtown	34	21	76	3	
2 Lebew, Calvin, Weikert (Ashby)	23	43	57		
3 Corydon, Edom	4	25	75		
4 Litz, Gilpin	34	9	88	3	
5 Huntington, Ashton	90	19	79	1	1
6 Pope, Cacapon	20	30	70		
7 Holston, Juniata, Ungers	10	10	90		
8 Brookside, Ryder, Huntington, local	5	40	60		
9 Laidig, Shelocta	14		100		
10 Lindsie, Clarksburg, Captina	45	7	93		
11 Philo, Buchanan, Ernest	26	12	88		
12 Atkins, Melvin	10	10	90		
13 Tyler, Brinkerton, Andover	17	6	94		
14 Monongahela, Cookport	17	18	82		
15 Purdy, Hollywood	2		100		
16 Alluvial land	6	83	17		
ALL	357	18	81	1	0

Kinds of Small Grains

Spring oats were seeded in about half of the rotations with small grains (Table 9). Winter barley and winter wheat were in nearly all of the remaining rotations, with barley occurring about twice as frequently as wheat.

TABLE 9

Kinds and combinations of small grain crops, 54 dairy farms, 294 fields, Appalachian Valley, West Virginia.

Kinds of Small Grains	Per Cent of Fields
Oats, spring	47
Barley, winter	33
Wheat, winter	18
Rye, winter	1
Oats, wheat, and barley mixture, winter	1
TOTAL	100

HAY CROPS

Hay crops appeared in a larger proportion of the rotations than did cultivated crops or small grain crops (Table 5). Of all the rotations, 92 per cent included a biennial or perennial crop harvested for hay or silage. Every farmer had hay in one or more fields.

Hay crops appeared in 80 per cent of the rotations in each of the soil groups, except the alluvial land (Table 10). These alluvial lands, identified as group 16, are subject to annual overflow, and on these the cropping system was primarily continuous corn.

TABLE 10

Proportion of fields by number of years of continuous hay crops in a rotation, by soil groups, 54 farms, Appalachian Valley, West Virginia.

Soil Group	Number of Fields	Number of Years of Continuous Hay										
		None	1	2	3	4	5	6	7	8	9	10+
1 Weikert (Ashby), Rushtown	34	Per cent of Fields										
2 Lehew, Calvin, Weikert (Ashby)	23			13	31	17	9	22	4			4
3 Corydon, Edom	4					25		25	50			
4 Litz, Gilpin	34	6	6		6	21	17	17	15		3	9
5 Huntington, Ashton	90	17	40	1	9	10	8	5	3	4		3
6 Pope, Cacapon	20	10	5	20	30		5	15				15
7 Holston, Juniata, Ungers	10		20	20	20	20		10				10
8 Brookside, Ryder, Huntington, local	5						40					60
9 Laidig, Shelocta	14		7	14	14	37	21			7		
10 Lindside, Clarksburg, Captina	45	2	2	7	20	23	50	20	2	2		2
11 Philo, Buchanan, Ernest	26		8	8	23	15	8	19	4	4		11
12 Atkins, Melvin	10	10	20	10	20	20		10				10
13 Tyler, Brinkerton, Andover	17	6	53		6	11	6		6	6		6
14 Monongahela, Cookport	17		12		29	29	12	12				6
15 Purdy, Hollywood	2		100									
16 Alluvial land	6	83	17									
ALL	357	8	17	5	14	17	12	13	4	3	0	7

Years of Hay Crops in a Rotation

No one specific number of years of hay in rotations was particularly dominant to all other periods of time. Of all fields, 17 per cent remained in hay for one year and then was returned to a cultivated or small grain crop. More than 50 per cent of all stands remained for three to six years. Only 14 per cent continued in hay for more than six years; this included the 7 per cent that had been in hay for 10 years and more. Except in the case of alluvial land, there was no evidence that differences in soil series influenced the length of the rotation.

Kinds of Hay Crops and Length of Stand

The kind of seeding had some relation to the number of years that stands were retained. In the fields seeded with alfalfa only, 80 per cent were kept for three to six years (Table 11). When other seeds were included with alfalfa, 76 per cent of the fields were kept from three to six years before reseeding.

When clovers were seeded alone, 85 per cent of the fields were harvested one season and then changed to another crop. For the most part, the clover seeding was red clover; the others included sweet and alsike. Seedings of clovers and grasses were kept for varying numbers of years; 28 per cent were retained one year; another 28 per cent were kept more than four years.

TABLE 11

Years that hay crops remained in the rotation by per cent of fields with each crop, 54 farms, Appalachian Valley, West Virginia.

Kinds of Seeding	Number of Fields	Years of Continuous Hay									
		1	2	3	4	5	6	7	8	9	10+
		Per cent of Fields									
Alfalfa only	55	5	4	24	20	12	24	4	5		2
Alfalfa and other legumes	17	12		12	58		6				12
Alfalfa, other legumes, and grasses	51	17	4	12	14	21	16	10	4		2
Alfalfa and grasses	89	2		18	20	20	18	7	5	1	9
ALL FIELDS											
WITH ALFALFA	212	7	2	18	22	17	18	6	4	0	6
Clovers	27	85	4	4							7
Clovers and grasses	74	28	14	14	16	5	7	3	1		12
Grasses only	17	6	17	12	24	12	17		6		6
ALL SEEDING	330	19	5	15	19	13	14	5	3	0	7

INFLUENCE OF SLOPE OF LAND

A close relationship existed between slope of land and the number of years of cultivated crops in a rotation. On the relatively level land, with a slope up to 3 per cent, 55 per cent of the land was in a cultivated crop for one year and then used for another class of crops (Table 12). On the level land, 12 per cent of fields had been in continuous corn for 10 or more years.

On the land with slopes of 4 to 10 per cent, 90 per cent of the fields was in corn one year, and then another crop was used. None of these fields were in corn for more than four years. Only 16 per cent of fields with a slope in excess of 10 per cent were in corn for more than one year in a rotation. From the viewpoint of controlling soil movement, it is interesting to observe that none of the fields having slopes in excess of 20 per cent were in corn.

Relatively level fields, including those with a slope up to 3 per cent, were in hay for a shorter period than fields with more slope (Table 13). One-third of the fields with relatively level land were in hay for one year, and then the crop was changed. Less than half of the fields remained in hay for more than three years before the crop was changed.

Only 3 per cent of the fields with slopes greater than 3 per cent were changed to another crop after one year of hay. This practice was followed without regard to the condition of the stand.

If the detailed data in Table 13 are accumulated, it is observed that 44 per cent of the field with slopes to 3 per cent were kept in hay for more than three years. Seventy-two per cent of the fields with slopes of 3 to 10 per cent were retained more than three years. Eighty-seven per cent with slopes of 11 to 20 per cent remained in hay more than three years. All fields with slopes over 20 per cent remained in hay for more than three years.

TABLE 12

Relationship of years of cultivated crop to slope of land, 54 dairy farms, Appalachian Valley, West Virginia.

Slope (Per cent)	Number of Fields	Years of Cultivated Crops					
		1	2	3	4	5	10+
		<i>Per cent of Fields</i>					
0-3	159	55	22	8	1	2	12
4-10	78	90	8	1	1		
11-20	31	84	16				
21 and over .	0						
TOTAL ..	268						

TABLE 13

Relationships of years of continuous hay to slope of land, 54 dairy farms, Appalachian Valley, West Virginia.

Slope (Per Cent)	Number of Fields	Years of Continuous Hay									
		1	2	3	4	5	6	7	8	9	10+
		<i>Per cent of Fields</i>									
0-3	164	34	5	17	11	9	10	3	4		7
4-10	103	3	6	19	24	13	17	7	4		7
11-20	59	3	7	3	29	22	20	5	2	2	7
21-30	2				50						50
31-40	2				50	50					
TOTAL	330										

As the slope of land increased, stands remained in hay for longer periods of time. Some fields on all slopes remained for many years; however, less than 10 per cent of the fields with slopes up to 20 per cent remained in hay for more than eight years.

ROTATIONS

Rotations may be described in various ways. One way is to classify the crops into three major categories: cultivated crops, small grains, and hay crops. With this method, 62 per cent of the fields had rotations including each of the three classes of crops (Table 14). Twenty-seven per cent of the rotations included only two kinds of crops. Of these, the rotation of small grain and hay was most important, accounting for 19 per cent of all rotations. In 6 per cent of the fields the rotation involved a hay crop that was reseeded to hay without a companion crop or without a seeding to a different class of crop before returning to hay. In 5 per cent of the fields, the crops had been one or another kind of cultivated crop for 10 years.

Another procedure for classifying crops is to identify specific kinds of crops or specific combinations that were treated as a mixed seeding. Illustrations of specific cultivated crops included corn, sorghum, and soybeans. Illustrations of hay crops included alfalfa, red clover, alsike, orchardgrass, brome grass, and timothy seeded either alone or in various combinations.

If rotations are defined in terms of a systematic crop sequence and are considered to be different when there is a change in the crop, a change in the number of years for each crop, or a change in the combinations of grasses and legumes seeded in combination, then there is very little similarity in rotations.

TABLE 14

Rotations according to the inclusion of cultivated crops, small grains, and hay, 54 dairy farms, Appalachian Valley, West Virginia, 1959.

Class of Crops	Number of Fields	Per cent Fields
Cultivated crops, small grain and hay . . .	221	62
Small grain and hay	66	19
Cultivated crops and hay	22	6
Cultivated crops and small grain	7	2
Hay replanted to hay	23	6
Cultivated crops	18	5
ALL FIELDS	357	100

In this latter procedure for classifying rotations, the kinds of seeds were considered, but the relative proportions were ignored. Run-out or native seedings were also disregarded. Whenever a single crop or mixture of crops remained the same for 10 years or more, the interval of time was treated as 10 years because precise number of years in excess of 10 was difficult to determine.

Fifty-six per cent of the fields had a rotation that was different from all others (Table 15). Each rotation was different; it was not duplicated in another field. Eighteen per cent of the rotations were duplicated in only one of the 357 fields. Only 34 per cent of these same duplicates were in fields having soils in the same soil groupings.

Continuous corn was the only cropping system repeated more than six times. Corn had been grown for 10 or more years in 5 per cent of the fields. It was produced in 17 per cent of the fields for 10 or more consecutive years. Of the fields in continuous corn, 59 per cent were soil group

TABLE 15

*Rotations according to the number and frequency of occurrence, 54 dairy farms, Appalachian Valley, West Virginia, 1959.**

Frequency of Repetition of Rotations	Number of Rotations	Total Number of Fields	Per cent of Fields
1	201	201	56
2	32	64	18
3	8	24	7
4	6	24	7
5	3	15	4
6	2	12	3
17	1	17	5
TOTALS	253	357	100

*Rotation, in this instance, is defined in terms of a systematic crop sequence. A difference occurs among rotations when there is a different crop, different number of years for each crop, or a difference in the combination of grasses and legumes seeded.

five, 12 per cent soil group six, and 29 per cent soil group 16. The soils in these three groups were deep, well-drained, bottom soils.

The implication of this variability of crops and combinations is that farmers consider each field on its own merits. They are not committed to systematic sequence or a specific regularity. If one crop is not appropriate, another is used. If the stand of a seeding is maintained, or if desirable volunteer crops replace the seeding, the forage crop is continued rather than replaced in conformance with a schedule.

SEEDING FOR HAY CROPS

The selection of the different kinds, and even varieties, and the quantities of seed used are important decisions in forage production. The selection influences the kind of forage and the success of the production.

Seeding of a single kind of forage crop occurred in 36 per cent of the fields (Table 16). Of the single seedings, alfalfa occurred most frequently. When seeded alone, it accounted for 14 per cent of all fields. Timothy was next in importance, and then red clover.

Mixtures of seeds accounted for 64 per cent of all forage seedings. Not only was alfalfa the most important among single seedings, it was also the most important in mixtures. Of all the mixtures studied, 54 per cent included alfalfa. In mixtures, as in individual seedings, timothy was second in importance, occurring in 44 per cent of all fields. Red clover ranked third and was included in 41 per cent of the seedings. Orchard-grass was included in 27 per cent of the mixtures.

Rates of seeding of single species were nearer to recommended rates than were mixtures. The State Extension Service recommendations for alfalfa seeding is 16 pounds per acre, while the average used was 17 pounds. Red clover seedings averaged 15 pounds, exceeding the recommended 10 pounds. Timothy seedings averaged six pounds, compared with a recommended eight pounds. Many forage seeding mixtures exceeded 20 pounds per acre, and some exceeded 30.

Kinds and Varieties of Seed

Variety selection is important as a factor associated with production. Alfalfa seeds were generally selected by variety (Table 17). Only two per cent of the fields with alfalfa were seeded with unknown varieties. On the other hand, one-third of the fields was still seeded with Kansas common alfalfa which is no longer recommended. Seeds other than alfalfa and two varieties of lespedeza were seeded by kind without any identity as to variety.

TABLE 16

Seed, seeding mixtures, and rate of seeding, Appalachian Valley, West Virginia, 1958-1959.

Kinds and Pounds of Seed per Acre										Number of Fields	Average Pounds Per Acre
Alfalfa only 17										29	17
Alfalfa, Other Legumes											
Alfalfa	11	Red Clover	6							7	17
Alfalfa	24	Ladino	1.2							1	25
Alfalfa	20	Red Clover	2	Alsike	3					1	25
Alfalfa	6	Red Clover	2	Alsike	1	Ladino	.5			1	10
Alfalfa	10	Alsike	2	Ladino	.8	Lespedeza	5				
						Trefoil	1			1	19
Alfalfa, Other Legumes and Grasses											
Alfalfa	10	Red Clover	9	Timothy	5					9	24
Alfalfa	8	Red Clover	5	Orchard	2					6	15
Alfalfa	11	Alsike	8	Timothy	8					3	27
Alfalfa	4	Red Clover	4	Alsike	3	Timothy	4			3	15
Alfalfa	15	Ladino	1.1	Orchard	5					4	21
Alfalfa	15	Ladino	.5	Trefoil	2	Brome	2			1	20
Alfalfa	18	Red Clover	3	Brome	4					1	25
Alfalfa	17	Trefoil	1	Orchard	2					1	20
Alfalfa	4	Red Clover	2	Alsike	2	Ladino	.8				
						Orchard	8			2	17
Alfalfa	5	Red Clover	12	Timothy	6	Orchard	.5			3	23
Alfalfa and Grasses											
Alfalfa	14	Timothy	6							8	20
Alfalfa	13	Orchard	6							20	19
Alfalfa	14	Brome	7							5	21
Alfalfa	14	Timothy	6	Orchard	3					2	23
Alfalfa	15	Red Top	3							1	18
Legumes Other than Alfalfa											
Sweet Clover only			18							1	18
Red Clover only			15							12	15
Trefoil only			10							1	10
Lespedeza only			18							1	18
Red Clover	8	Alsike	8							1	16
No Alfalfa, Legumes and Grasses											
Red Clover	11	Timothy	5							29	16
Red Clover	10	Orchard	10	Ky. 31 and							
				Alta Fescue	2					1	22
Red Clover	16	Orchard	1	Lespedeza	4					1	21
Red Clover	6	Orchard	1	Timothy	2					1	9
Red Clover	10	Timothy	10	Red Top	4					1	24
Red Clover	8	Alsike	8	Timothy	6	Red Top	2			1	24
Red Clover	19	Orchard	5	Bluegrass	10					2	34
Alsike	3	Orchard	10							1	13
Alsike	10	Ladino	1.0	Orchard	12	Fescue	2			1	25
Alsike	5	Timothy	9							2	14
Trefoil	3	Orchard	13							1	16
Lespedeza	13	Orchard	7							1	20
Mixed legumes and grasses, kinds unknown					31					2	31
Grasses Only											
Timothy	10	Red Top	2							3	12
Timothy	1.4	Orchard	.4							2	2
Orchardgrass only			8							6	8
Timothy only			6							22	6

TABLE 17

Kinds and varieties of seeds and their proportion of certification and inoculation by fields, Appalachian Valley, West Virginia, 1958-1959.

Kinds and Variety	Number of Farmers	Number of Fields	Fields with Certified Seed	Fields with Inoculated Legumes
Alfalfa			<i>Per cent</i>	
Kansas Common	21	34	100	65
Atlantic	10	16	94	94
Vernal	4	8	100	100
Williamsburg	5	9	100	78
Narragansett	5	6	100	50
Ranger	7	9	100	89
Buffalo	7	9	100	67
Du Puits	2	2	100	100
Grimm	2	2	100	100
Vernal and Williamsburg	1	1	100	100
Vernal and Narragansett	1	1	100	100
Williamsburg and Narragansett	1	1	100	
Unknown	8	9	89	
Red Clover	37	83	30	45
Alsike	10	17	100	82
Lespedeza				
Korean	2	2	100	100
Kobe	1	1	100	0
Unknown	1	1	0	0
Ladino	5	11	100	90
Sweet Clover	2	2	100	0
Trefoil	5	5	100	60
Timothy	51	89	98	
Orchardgrass	31	57	91	
Bromegrass	4	7	100	
Fescue	1	2	100	50
Pre-mixed	2	4	75	0
TOTAL REPORTS		388		

Certified Seed

Certified seed is an indicator of quality. Most producers used certified seed for each kind of seed.

Inoculation

Inoculation is a cultural practice generally followed with alfalfa. It is followed less consistently with other legumes. Only 45 per cent of the red clover seedings were inoculated.

Dates For Seeding Legumes

Most of the legumes are seeded in the spring, with 75 per cent seeded by the end of May (Table 18). Some were seeded in the remaining summer months, but none after October.

TABLE 18

Kinds of seeding mixtures, proportion of fields by month of legume seeding, Appalachian Valley, West Virginia, 1958-1959.

Kind of Mixture	Number of Fields	Month of Legume Seeding									
		Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	
Per cent of Fields											
Alfalfa, alone	28		7	41	17			7	21	7	
Alfalfa, other legumes	11		36	55	9						
Alfalfa, other legumes and grasses	33	12	3	43	18	6	3	9	6		
Alfalfa and grasses	32		6	35	9	3		19	19	9	
Sweet Clover only	1			100							
Red Clover only	12		50	25	17			8			
Trefoil only	1				100						
Lespedeza only	1			100							
No alfalfa, other legumes only	2			100							
No alfalfa, legumes and grasses	43	2	37	40	5	2			7	7	
ALL LEGUMES	164	3	19	41	12	2	1	7	10	5	

The most significant month for seeding alfalfa was April. This seedling period was most important when alfalfa was seeded alone or in mixture.

Other legumes were more consistently seeded in the spring than alfalfa. March and April were the principal months.

Dates For Seeding Grasses

Unlike legumes, most of the seedings of grass were made after the harvest of another crop (Table 19). With legumes, 75 per cent were seeded from February to the end of May, but only 45 per cent of the grasses were seeded in that season.

Part of the grasses were seeded with small grains and part were seeded alone. Sometimes legumes and grasses were seeded at the same time; however, in other instances, grasses to be included in the forage mixture were seeded in the fall and legumes the following spring.

Some fields were seeded with legumes only, and others were seeded with grasses only. When these were compared, 80 per cent of the legumes were seeded in the spring; whereas, 82 per cent of the grasses were

TABLE 19

Kinds of seeding mixtures, proportion of fields by months of grass seeding, Appalachian Valley, West Virginia, 1958-1959.

Kind of Mixture	Number of Fields	Month of Grass Seeding									
		Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
		<i>Per cent of Fields</i>									
Alfalfa, other legumes and grasses . . .	33	3	3	37	15	3	3	12	18	6	
Alfalfa and grasses	31		3	29	10	3		19	26	10	
No alfalfa, legumes and grasses	43		19	35	5	2			12	25	2
Grass mixtures . .	5			20					80		
Orchardgrass only	6		33	33					17	17	
Timothy only	22		5						36	59	
ALL GRASSES	140	1	9	28	7	2	1	7	23	21	1

seeded in the fall. When timothy was seeded alone, 95 per cent of the fields were seeded in September and October.

USE OF COMPANION CROPS

Companion crops were generally used in the seeding of grasses and legumes (Table 20). Even though grasses tended to be seeded in the fall and legumes in the spring, the seeding of these crops was not limited to the seeding of fall and spring grains.

The principal companion crop used for hay seedings was oats. Oats were particularly important with legumes; oats were seldom used when timothy was the only crop in the hay seeding.

Barley ranked second to oats in per cent of fields where a companion crop was used with a hay seeding. It was about equally important with legume and grass seedings.

Wheat was somewhat less important as a companion crop than barley. Mixed grains and rye were seldom used in a companion seeding with hay crops.

SEEDING RATE FOR COMPANION GRAINS

The rate of seeding of oats, when used as a companion crop, was generally less than the rate for other small grains (Table 21). Seeding rates varied upward from 54 pounds when alfalfa and clovers were in

TABLE 20

Kinds of companion crops and proportion of fields seeded to each with seeding of hay type crops, Appalachian Valley, West Virginia, 1958-1959.

Seeding Mixture	Number of Fields	Companion Crops					
		Oats	Wheat	Barley	Mixed Grain	Rye	None
		<i>Per cent of Fields</i>					
Alfalfa alone	29	55		24			21
Alfalfa, other legumes	11	27	27	37			9
Alfalfa, other legumes and grasses	33	52	15	15			18
Alfalfa and grasses	36	38	11	22	7		22
Sweet Clover only	1	100					
Red Clover only	12	31	31	38			
Trefoil only	1						100
Lespedeza only	1	100					
Mixed legumes and grasses	2	100					
No alfalfa, other legumes only	1	100					
No alfalfa, legumes and grasses	44	32	27	34	3	2	2
Grasses only	5	40	20	20			20
Orchardgrass only	6		33				67
Timothy only	22	9	45	46			

the field. Seeding of wheat when hay crops were seeded in the field varied from 85 to 124 pounds, with two bushels of wheat being the most common rate. Barley was generally seeded at a rate of two bushels or 96 pounds per acre.

RUN-OUT OF HAY SEEDING AND VOLUNTEER STANDS

Farmers change crops in a particular field for various reasons. Some farmers follow a system which provides for orderly changing at regular intervals. Others change the crop because it does not furnish the quantity desired, because the initial seeding fails to perform to expectations, or because undesirable vegetation appears.

Decrease in initial seeding is a critical problem. It may be influenced by accumulation of weeds, insects, diseases, insufficient nutrients, and seedings not adapted to the soil type.

In this reporting of forage run-out and volunteer stands, soils are combined into four categories rather than the 16 groups used earlier. One combination is soil groups one through four, shallow, well-drained soils (Table 4). A second combination includes soil groups five through nine.

TABLE 21

Kinds and pounds of seed applied per acre as companion crops in the seeding of forages, Appalachian Valley, West Virginia, 1958-1959.

Seeding Mixture	Number of Fields	Number of Fields Companion Crop	Companion Crop			
			Oats	Wheat	Barley	Rye
			<i>Pounds Seeded per Acre</i>			
All alfalfa	29	23	59		94	
Alfalfa, other legumes	11	9	54	85	96	
Alfalfa, other legumes and grasses	33	26	59	93	93	
Alfalfa, grasses	36	25	79	120	67	
Sweet Clover only	1	1	64			
Red Clover only	12	12	63	120	98	
Trefoil only	1					
Lespedeza only	1	1	56			
Mixed legumes and grasses	2	1	80			
No alfalfa, other legumes only	1	1	56			
No alfalfa, legumes and grasses	44	41	67	124	99	84
Grasses only	5	4	64	120	96	
Orchardgrass only	6	2			108	
Timothy only	22	22	72	117	98	126

deep, well-drained soils. A third combination includes soil groups 10, 11, and 14, deep, moderately well-drained soils. The fourth combination includes soil groups 12, 13 and 15, deep, somewhat poorly and poorly drained soils. Soil group 16 was not included in the analysis since it is overflow land and generally replanted with corn.

Decreases in Alfalfa

Alfalfa stands in some fields and on some soil types began declining during the first year of the stand (Table 22). There were no fields where alfalfa completely ran out during the first year.

In the two-year-old stands, decreases in alfalfa ranged from 14 per cent of the fields with well drained soils to 100 per cent of the fields with somewhat poorly drained soils. There were no fields with well-drained soils where alfalfa completely ran out during the second year, but 10 per cent of the fields on the moderately well-drained soils lost all the alfalfa.

Three-year-old stands showed substantial decreases of alfalfa, ranging up to 83 of the fields in shallow soils.

Four-year-old stands showed noticeable decreases in alfalfa. Five-

TABLE 22

Alfalfa stand decrease and run-out and volunteer stands of legumes by soil groups and age of stands, Appalachian Valley, West Virginia, 1958-1959.

Soil Group	Age of Stand	Number of Fields	Fields Alfalfa Run Out	Fields Alfalfa Decrease	Fields Legumes Increase	Kind of Volunteer Legumes
1-4	1	11	<i>Per cent</i>			White Clover and Lespedeza
	2	7		9		
	3	6		14	17	
	4	10		83		
	5 and over	15	7	60	14	
5-9	1	12		87		White Clover and Lespedeza
	2	6		17	17	Red Clover
	3	10	10	17		White Clover
	4	8	12	60		
	5 and over	9	22	75	11	
10, 11, 14	1	7		100		White Clover and Sweet Clover
	2	10	10	28		
	3	7		80		
	4	4		43	25	
	5 and over	6	17	50	17	
12, 13, 15	1	2		0	50	White Clover
	2	1		100		White Clover
	3	0		0		
	4	0		0		
	5 and over	1		100		

year-old stands showed continued marked decreases, with many fields completely run out of alfalfa.

As alfalfa ran out, other vegetation replaced it. White clover, red clover, lespedeza, and sweet clover were the legumes which appeared as volunteer seeding. However, some farmers reported that volunteer crops were introduced with the spreading of manure.

Decreases in Red Clover

A relatively small proportion of the fields in which red clover was a part of the seeding mixture showed decreases in red clover during the first year (Table 23). Noticeable decreases occurred with two year-old stands. Complete run-out began during the second year of stands.

The actual situation with run-out of red clover is difficult to determine because red clover does occur in fields as a volunteer stand. To distinguish between red clover mechanically seeded and the volunteer clover would be extremely difficult.

White clover, lespedeza, and sweet clover were legumes which came in by natural seeding. These began appearing in the four year-old stands.

TABLE 23

Red clover stand decrease and run-out and volunteer stands of legumes by soil groups and age of stands, Appalachian Valley, West Virginia, 1958-1959.

Soil Group	Age of Stands	Number of Fields	Fields Red Clover Run Out	Fields Red Clover Decrease	Fields Legume Increase	Kind of Volunteer Legumes
			<i>Per cent</i>			
1-4	1	2	0	0		
(shallow, upland, well-drained)	2	2	0	100		
	3	1	0	100		
	4	4	75	100	25	White Clover
	5 and over	5	40	60	20	Lespedeza
5-9	1	16	0	6		
(deep, well-drained)	2	4	50	75		
	3	2	50	100		
	4	3	67	100		
	5 and over	3	33	33		
10, 11, 14	1	4	50	50		
(deep, moderately well-drained)	2	4	25	75		
	3	5	40	80		
	4	3	67	100	33	White Clover
	5 and over	5	20	60	40	Sweet Clover
12, 13, 15	1	3	0	0		
(deep, poorly-drained)	2					
	3					
	4	3	0	100	33	White Clover
	5 and over	1	0	0		

Decreases in Timothy

Decreases in timothy stands during the first year were relatively unimportant (Table 24). As the age of stand increased, decreases did occur. However, there was relatively little evidence of complete run-out during the first five years of the stand.

Decreases in Orchardgrass

None of the fields seeded to orchard grass showed a complete loss of stand. Only 20 per cent of the fields had a decrease in the stands during any one of the first five years. Orchardgrass appears in stand on a volunteer basis and the volunteer seeding may account for this evidence of continuity.

Volunteer Grasses and Weeds in Alfalfa

In alfalfa stands the appearance and progress of volunteer grasses and weeds was more rapid than the appearance and progress of volunteer legumes. On the deep, well-drained soil, 25 per cent of the fields had natural seeding of grasses in one-year-old alfalfa stands (Table 25). By

TABLE 24

Timothy stand decrease and run-out and native seeding of legumes by soil groups and age of stands, Appalachian Valley, West Virginia, 1958-1959.

Soil Group	Age of Stands	Number of Fields	Fields Timothy Run Out	Timothy Decrease	Legume Increase	Kind of Volunteer Legumes
	Years			Per cent		
1-4 (shallow, upland, well-drained)	1	2	0			White Clover and Lespedeza
	2	2	0			
		5	0	60	20	
	3					
	4	7	0	57	14	
	5 and over	11	0	64	9	White Clover
5-9 (deep, well-drained)	1	7	0	14	0	Red Clover
	2	5	0	20	20	
	3	2	0	50	0	
	4	2	0	0	0	
	5 and over	2	0	50	0	
10, 11, 14 (deep, moderately well-drained)	1	5	0	40		White Clover and Sweet Clover
	2	5	0	80		
	3	7	0	57		
	4	6	0	67	34	
	5 and over	6	17	67	17	
12, 13, 15 (deep, poorly-drained)	1	1	0	0	0	
	2	0	0	0	0	
	3	0	0	0	0	
	4	1	0	100	0	
	5 and over	1	0	0	0	

the time stands were three years old, the majority had volunteer grasses or weeds.

Bluegrass was the most aggressive of volunteer plants in alfalfa. It appeared early in stands and accounted for the greater per cent of all volunteers in all ages of stands.

Orchardgrass was second to bluegrass as a volunteer stand in alfalfa fields. Other naturally seeded plants occurred to a lesser extent than bluegrass and orchardgrass.

Volunteer Grasses and Weeds in Other Seedings

In red clover fields, volunteer seedings were particularly noticeable in two-year-old seedings and continued to increase as the age of the clover stand increased.

No volunteer plants occurred in the first year of timothy stands, but they began in the second year. In the three-year-old stands of timothy, most fields had volunteer plants.

Orchardgrass seedings also had volunteer plants. They began in the first year and increased with age of stand.

TABLE 25

*Volunteer stands other than legumes appearing in fields with alfalfa seedlings by soil groups and age of stands, Appalachian Valley, West Virginia, 1958-1959.**

Soil Group	Age Stands	Number of Fields	Fields With Volunteer (Per cent)	Kinds of Volunteer Plants								
				Blue-grass	Orchard	Brome	Red Top	Johnson	Wild	Cheat	Crab	Garlic
Per cent of all Fields with Plants												
1-4	1	11	0									
(shallow, upland, well-drained)	2	7	14	14								
	3	6	50	33				17				
	4	10	40	30					10	10		
	5 and over	15	93	66	27	7	7			13		
5-9	1	12	25	9	8		8					
(deep, well-drained)	2	6	50	16	17			17				
	3	10	50	40	10						10	
	4	8	62	38	12				25		13	
	5 and over	9	89	78	11	11	11					
10, 11, 14	1	1	7	0								
(deep, moderately well-drained)	2	10	50	50								
	3	7	43	29					14			
	4	4	75	50	50							
	5 and over	6	50	50						16		
12, 13, 15	1	2	0									
(deep, poorly-drained)	2	1	0								17	
	3	0	0									
	4	0	0									
	5 and over	1	0									

*In some cases more than one volunteer plant was important. In these instances the addition of kinds of plants exceeds per cent shown in the column headed "Fields with Volunteer."

Bluegrass was the principal volunteer stand in fields with the mixtures evaluated. Orchardgrass was second in importance.

Native seedlings can serve several purposes for the farmer. However, if the natural seeding replaces more desirable feed crops, then the purpose of the initial seeding is lost and the production is likely to decline. Forage is an important factor in livestock production and, in turn, influences production.

CONCLUSIONS

Farmers are adapting their cropping programs to the land. Land that is relatively level and productive is intensively cropped. As the slope increases, the proportion of the land in cultivated crops decreases.

Standard rotations are not practiced on farms. Rotations are adjusted to the land and the crop. The years of hay in the rotation show a relationship to the decrease in the proportion of the desirable species. As the stand of the seeded forage crop declines, vegetation is replaced by native stands of bluegrass, clovers, and orchardgrass.