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STAFF PAPER

DERIVED LABOR REQUIREMENTS FOR EASTERN KANSAS CROPS

LARRY N. LANGEMEIER, KIM WITT,
AND CHRIS AKHIMIEN*

August 1990
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Department of Agricultural Economics
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DERIVED LABOR REQUIREMENTS FOR EASTERN KANSAS CROPS*

*Larry N. Langemeier, Kim Witt, and Chris Akhimien***

A significant change in agriculture has been the decrease in labor required per crop acre with the continuous shift to larger machinery and equipment. The larger machinery permits producers to handle more crop acres. Hours of labor available for crop production increased 8.1 percent between 1975 and 1989 on Kansas Farm Management Association, N.E. and S.E., cash crop dryland farms; total crop acres increased 58.6 percent.[1]

Producers, agri-business firms, and others need current information on crop-labor requirements. Management considerations of new machinery investments, additional land purchases, enterprise analyses, and cost of production budgets require labor information for various crops. The rapid changes in machine sizes and field operations call for current crop-labor standards.

DATA CONSIDERATIONS AND METHODOLOGY

Information on tillage, planting, and harvesting-machine operations was obtained from Farm Management Association fieldmen.[2] Also, machinery dealers provided information on small, average, and large machine sizes for their trade areas and their expectations on future machine sizes. Specific information required for each crop was: type of machine operations, machine sizes, months machines were used, and number of times over a given acre for each machine (see Appendix Tables 1-8).

Machine sizes vary by farm size. Three farm sizes were considered based on farms enrolled in the northeast (N.E.) and southeast (S.E.) Farm Management Associations: small (100-375 crop acres); average (375 - 1,100 crop acres); and large (more than 1,100 crop acres). Among these farm sizes, only the machine size was adjusted.

A computerized machinery investment generator program[3] was used to develop the "field time" or "machine hour" requirements for each crop, considering machinery type and size and number of tillage, planting, and harvesting operations. Machine hours--hours that a machine must be operated to complete a specific operation for one acre--were computed by this formula:

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*Contribution No. 91-88-D from the Kansas Agricultural Experiment Station.

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[1]Larry N. Langemeier, "The Annual Report, Management Information, 1975 and 1989," Department of Agricultural Economics, Cooperative Extension Service, Kansas State University, Manhattan, Kansas, 66506.

[2]Farm management association fieldmen from Kansas Farm Management Associations, N.E. and S.E., provided most of the information on machine sizes and operations.

[3]A micro-computer model was developed specifically for this project as a means of estimating crop-labor standards and machinery investment requirements.

$$\text{Hours per acre} = \frac{1.0}{((S) \times (W) \times (E)/8.25)}$$

Where, S = Average speed (mph) a machine travels
W = Machine's capacity in feet
E = Field efficiency of the machine

Field efficiency is the ratio of the actual capacity of a machine to its theoretical capacity. The field efficiency factor accounts for overlap and failure to use the machine's full operating width, turning time, and such machine servicing as filling seed boxes. Field efficiencies vary with sizes and shapes of fields and field conditions.

Field-labor hours were obtained by multiplying total machine hours by 1.30 to reflect additional time to travel to and from the field, adjust equipment, lubricate, and do repairs and maintenance work. Labor standards for each crop included an indirect labor charge of .15 (.075 for alfalfa hay and sorghum silage) times field-labor hours for time required for accounting, managing, meetings, marketing, using auto and pickup, and purchasing repair parts.[4]

DERIVATION OF CROP LABOR REQUIREMENTS

Table 1 shows field-labor hour requirements by month for each crop. Though labor distribution during the year varies from farm to farm (depending on weather, field conditions, and when a given machine operation is done), total field-labor-hour requirements for a given crop will not be changed by shifting a machine operation to another month.

Table 2 shows field-labor-hour "standards" by month for each crop. The standards were derived by weighting the hours for small, average, and large sized farms by the proportion of total cash crop dryland farms in the 100-375, 375-1,100, and more than 1,100 crop acre categories, respectively, in Farm Management Associations, N.E. and S.E. Labor requirements per acre for grain and row crops ranged from 1.48 hours for oats to 2.60 hours for corn. Table 3 shows field-labor-hour standards for each crop on a percentage basis. Percentages would become important should labor standards change in the future.

Table 4 presents the tillage-planting, harvesting, and indirect labor requirements for the small, average, and large farms and the weighted standards.[5] Harvesting hours were similar for wheat, oats, soybeans, and grain sorghum because only combine size was varied. Crop yields, plant lodging, and field conditions are other factors that affect field efficiencies and, therefore, change harvesting-time requirements.

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[4]The field-labor-hour adjustment and indirect labor charge factors were 1.25 and .125 for central Kansas; 1.20 and .10 for western Kansas.

[5]Tillage-planting and harvesting requirements were derived from the information outlined in Tables 1 and 2. Custom tillage, planting, or harvesting operations were not considered.

Table 1. Estimated Field-Labor-Hours* per Acre for Indicated Crops, Small, Average, and Large Farms, Eastern Kansas, 1989**

Months	Wheat	Corn	Soybeans	Grain Sorghum	Oats	Sorghum Silage	Bromegrass***	Alfalfa Hay***
				(hours per acre)				
Small-size farm								
January							0.03	
February					0.37		0.09	
March					0.32			
April	0.08	0.31	0.22	0.32		0.25		0.08
May		0.37	0.33	0.28		0.30		
June	0.50	0.38	0.23	0.52	0.72	0.28	1.98	2.03
July	0.37	0.15	0.08			0.27	0.02	2.09
August	0.34						0.04	1.06
September	0.40		0.17	0.49		1.03	0.04	0.62
October	0.15	0.61	0.64	0.33		2.98		
November		1.41	0.53	0.29	0.29	0.29		
December		0.09						
TOTAL	1.84	3.32	2.20	2.23	1.70	5.40	2.20	5.88

Table 1. Estimated Field-Labor-Hours* per Acre for Indicated Crops, Small, Average, and Large Farms, Eastern Kansas, 1989** (Continued)

Months	Wheat	Corn	Soybeans	Grain Sorghum	Oats	Sorghum Silage	Bromegrass***	Alfalfa Hay***
				(hours per acre)				
Average-size farm****								
January							0.03	
February					0.28		0.09	
March					0.24			
April	0.08	0.24	0.19	0.28		0.21		0.07
May		0.26	0.26	0.22		0.24		
June	0.46	0.26	0.16	0.35	0.66	0.19	1.98	2.02
July	0.32	0.10	0.05			0.18	0.02	2.07
August	0.28						0.02	1.05
September	0.32		0.14	0.45		1.03	0.03	0.61
October	0.11	0.47	0.50	0.29		2.98		
November		0.98	0.43	0.23	0.25	0.23		
December		0.08						
TOTAL	1.57	2.39	1.73	1.82	1.43	5.06	2.17	5.82

Table 1. Estimated Field-Labor-Hours* per Acre for Indicated Crops, Small, Average, and Large Farms, Eastern Kansas, 1989** (Continued)

Months	Wheat	Corn	Soybeans	Grain Sorghum	Oats	Sorghum Silage	Bromegrass***	Alfalfa Hay***
				(hours per acre)				
Large-size farm								
January							0.03	
February					0.20		0.09	
March					0.18			
April	0.08	0.17	0.12	0.22		0.16		0.06
May		0.19	0.19	0.16		0.17		
June	0.43	0.19	0.12	0.26	0.62	0.14	1.59	1.61
July	0.30	0.08	0.04			0.13	0.01	1.65
August	0.19						0.03	0.85
September	0.24		0.11	0.38		1.03	0.03	0.49
October	0.09	0.38	0.42	0.25		2.98		
November		0.85	0.36	0.17	0.21	0.17		
December		0.07						
TOTAL	1.33	1.93	1.36	1.44	1.21	4.78	1.78	4.66

*Field-labor hours (tillage-planting-harvesting) were computed by multiplying total machine hours-field time -by 1.30 to reflect the additional time required for traveling to and from the field, adjusting equipment, maintenance, lubrication, and small and irregularly shaped fields in Eastern Kansas.

**Estimates are for 1989 using best sources available supplemented by actual farm information, although previous years' experiences would influence estimates.

***Tillage and planting operations for bromegrass and alfalfa hay were pro-rated over 10 and 5-year periods, respectively.

****A representative or middle group of farms with acreage ranging from 375-1,100 crop acres.

Table 2. Derived Field-Labor Hour per Acre Standards for Indicated Crops, Eastern Kansas, 1989*

Months	Wheat	Corn	Soybeans	Grain Sorghum	Oats	Sorghum Silage	Bromegrass	Alfalfa Hay
				(hours per acre)				
January							0.03	
February					0.29		0.09	
March					0.25			
April	0.08	0.25	0.19	0.28		0.21		0.07
May		0.28	0.27	0.23		0.25		
June	0.47	0.28	0.17	0.39	0.67	0.21	1.91	1.95
July	0.33	0.11	0.06			0.20	0.02	2.00
August	0.28						0.03	1.02
September	0.33		0.14	0.45		1.03	0.03	0.60
October	0.12	0.50	0.53	0.30		2.98		
November		1.09	0.45	0.24	0.27	0.24		
December		.09						
TOTAL	1.61	2.60	1.81	1.89	1.48	5.12	2.11	5.64

*Derived by weighting hours in Table 1 for small, average, and large farms by the proportion of total farms represented by the number of cash crop-dryland farms with 100-375, 375-1100, and more than 1100 crop acres respectively, in Kansas Farm Management Associations, N.E and S.E.

Table 3. Derived Field-Labor Hour per Acre Standards on a Percentage Basis for Indicated Crops, Eastern Kansas, 1989

Months	Wheat	Corn	Soybeans	Grain Sorghum	Oats	Sorghum Silage	Bromegrass	Alfalfa Hay
				(%)				
January							1.61	
February					17.77		4.18	
March					15.38			
April	4.97	9.62	10.50	14.81		4.10		1.22
May		10.77	14.92	12.17		4.88		
June	29.19	10.77	9.39	20.63	40.59	4.10	90.45	34.61
July	20.50	4.23	3.31			3.91	0.88	35.52
August	17.39						1.22	18.09
September	20.50		7.73	23.81		20.12	1.66	10.56
October	7.45	19.23	29.28	15.87	3.94	58.20		
November		41.92	24.87	12.71	22.32	4.69		
December		3.46						
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 4. Tillage-Planting, Harvesting, and Indirect Labor Requirements per Acre for Indicated Crops, Eastern Kansas, 1989

Crop	Small-Sized Farm				Average-Sized Farm			
	Tillage-Planting	Harvesting*	Indirect**	Total	Tillage-Planting	Harvesting*	Indirect**	Total
	(hours per acre)							
Wheat	1.10	0.74	0.28	2.12	0.90	0.67	0.24	1.81
Corn	2.10	1.22	0.50	3.82	1.45	0.94	0.36	2.75
Soybeans	1.19	1.01	0.33	2.53	0.92	0.80	0.26	1.98
Grain Sorghum	1.41	0.82	0.33	2.56	1.08	0.74	0.26	2.08
Oats	0.98	0.72	0.24	1.94	0.78	0.66	0.22	1.66
Sorghum Silage	1.40	4.00	0.41	5.81	1.05	4.00	0.38	5.43
Bromegrass	0.22	1.98	0.33	2.53	0.19	1.98	0.33	2.50
Alfalfa Hay	0.33	5.55	0.44	6.32	0.28	5.55	0.44	6.27

Crop	Large-Sized Farm				Derived Standards***			
	Tillage-Planting	Harvesting*	Indirect**	Total	Tillage-Planting	Harvesting*	Indirect**	Total
	(hours per acre)							
Wheat	.70	0.63	0.20	1.53	0.93	0.68	0.24	1.85
Corn	1.18	0.76	0.29	2.23	1.60	0.99	0.39	2.98
Soybeans	0.69	0.67	0.22	1.58	0.96	0.84	0.27	2.07
Grain Sorghum	0.81	0.64	0.22	1.67	1.13	0.75	0.28	2.16
Oats	0.59	0.62	0.19	1.40	0.81	0.67	0.22	1.70
Sorghum Silage	0.78	4.00	0.36	5.14	1.11	4.00	0.38	5.49
Bromegrass	0.19	1.59	0.27	2.05	0.20	1.91	0.32	2.43
Alfalfa Hay	0.21	4.44	0.35	5.00	0.28	5.36	0.42	6.06

*Harvesting hours includes both labor for operation of harvesting equipment as well as hauling of grain, silage, and hay production.

**Indirect labor was derived as .15 (.075 for sorghum silage and alfalfa hay) times field-labor hours to account for accounting, management, attending meetings, marketing, using auto and pickup, and purchasing repair parts.

***Standard labor requirements were derived by weighting hours for small, average, and large farms by proportion of total farms represented by the number of cash crop dryland farms with 100-375, 375-1,100 and more than 1,100 crop acres, respectively, in Kansas Farm Management Associations, N.E and S.E.

Table 5. New (1989) and Previous Labor per Acre Standards for Indicated Crops Eastern Kansas

Crop Enterprise	New Standard (Hour)	Previous Standard* (Hour)	Change (%)
Wheat	1.85	2.37	-21.94
Corn	2.98	3.67	-18.80
Soybeans	2.07	2.84	-27.11
Grain Sorghum	2.16	2.52	-14.29
Oats	1.70	2.13	-20.19
Sorghum Silage	5.49	5.98	- 8.19
Bromegrass Hay	2.43	3.47	-29.97
Alfalfa Hay	6.06	9.48	-36.08

*Larry N. Langemeier, Orlan H. Buller, and John L. Kasper, "Labor Requirements for Eastern Kansas Crops", Contribution No. 582, Department of Agricultural Economics, Kansas State University, Manhattan, Kansas, 1975.

Table 5 shows the new and previous labor standards for each crop and the percentage changes. The new labor standards ranged from 8.19 to 36.08 percent less than previous standards. This difference was more significant in that only 69.0 percent of the derived labor standards reflects field time.

ACCURACY ANALYSIS OF NEW CROP LABOR STANDARDS

A representative farm (99 beef cows, 844 crop acres, 1.08 operators, 1040 hired-labor hours, and 215 acres of custom wheat harvest as noted in Table 6) was formulated from the 1989 records of Farm Management Association, N.E. and S.E., cash crop dryland farms to test the accuracy of the new crop-labor standards.

Total operator labor was assumed to be 210 hours per man per month. That is probably too many hours, considering the number of good field work days available each month. Because only 69.0 percent of the new crop-labor standards reflects actual field time, then 144.9 hours of every 210 hours available must be spent in field operations. Given a 10-hour day, weather and soil moisture conditions would need to permit 14.5 days of every month for field work.

Operator and full-time hired labor available for crop enterprises is shown in Table 6. Using the new labor standards and monthly percentages, hours required each month to handle crop production on the representative farm were computed. The difference between "hours required" and those "available" are shown as deficit labor hours.

If crop labor standards represent actual field conditions, then the total crop labor used to handle production on a given farm must be similar to the labor required as computed from the labor standards. Using the new labor standards, total deficit operator and full-time hired labor hours were 165, or a 45-hour surplus with 210 hours of part-time hired labor available.

SUMMARY

The computerized machinery investment generator program only approximates labor and machine hours for the tilling, planting, and harvesting operations a crop requires. But the new crop-labor standards computed using the technique-- 8.19 to 36.08 percent below those previously used--compared favorably with labor used on the representative farm.

A total of 31.0 percent of the labor time was used for repairs, lubrication, accounting, management, etc. Undoubtedly, nonfield hours are influenced by size and type of farm operation, so the percentage likely would not be the same for different sized farms. Additional study of nonfield hours per crop acre is required.

Table 6. Labor Requirements for a Representative Farm Using New Crop-Labor Standards, Eastern, Kansas

Representative Farm*

Livestock (head):

Beef cows	99.0

Crops (acres):

	Dryland
Wheat	269
Corn	80
Grain sorghum	127
Soybeans	283
Sorghum silage	8
Alfalfa hay	28
Idle	49
Total crop acres	844

Labor available (hours):

Operator	2700 (1.08 men)
Hired labor	830
Part-time hired labor	210

Custom harvest (acres):

Wheat	215

Month	Operator labor hours**	Hired labor employee hours	Available labor hours	New Standards: Hours required	New Standards: Deficit hours
January	159	69	228	0	0
February	159	69	228	0	0
March	159	69	228	0	0
April	159	69	228	154	0
May	159	69	228	149	0
June	159	69	228	222	0
July	159	69	228	109	0
August	159	69	228	131	0
September	159	69	228	240	12
October	159	69	228	325	97
November	159	69	228	284	56
December	159	69	228	8	0

Deficit labor hours	165
Part-time labor hours available	210
Surplus (deficit) labor hours	45

*Operator labor per man was assumed to be 210.0 hours per month. A year-round hired labor employee consisting of 830 hours was assumed, with 210 hours of part-time hired labor available. Part-time hired labor hours were calculated using a $6.00 per hour wage rate. Custom work for crops was assumed to be 90.0 percent of machine hire, with custom work allocated to wheat harvest.

**Beef cow labor requirements were removed from operator labor hours as follows: 8.0 hours per cow allocated evenly to each month (225 hours - 66 hours = 159 hours per month).

Appendix Table 1. Machinery Size and Operations per Acre for Winter Wheat in Eastern Kansas, 1989

Machine	Machine Size: Small farm	Average farm	Large farm	Times over	Months
Moldboard plow	7.5 ft.	9 ft.	10.5 ft.	.11	June
				.22	July
Tandem disk	15 ft.	18 ft.	27 ft.	1.50	Aug
				.50	Sept
Field cultivator	20 ft.	20 ft.	25 ft.	.70	Sept
				.30	Oct
Dry fertilizer spreader	25 ft.	25 ft.	25 ft.	.20	Sept
Combine, Self-prop.	16 ft.	18 ft.	20 ft.	.65	June
				.35	July
Drill/fertilizer	13 ft.	20 ft.	26 ft.	.60	Sept
				.40	Oct
Sprayer	20 ft.	20 ft.	20 ft.	.75	April
Tractor	55 h.p.	75 h.p.	120 h.p.		
Tractor	90 h.p.	120 h.p.	160 h.p.		
Two trucks*	.25	.24	.22		June
	.17	.15	.15		July

*Hours per acre.

Appendix Table 2. Machinery Size and Operations per Acre for Corn in Eastern Kansas, 1989

Machine	Machine Size: Small farm	Machine Size: Average farm	Machine Size: Large farm	Times over	Months
Stalk chopper	6 ft.	12 ft.	12 ft.	1.00	Nov
Moldboard plow	7.5 ft.	9 ft.	10.5 ft.	.33	Nov
				.17	Dec
Chisel plow	12 ft.	16 ft.	20 ft.	.50	Nov
Dry fert'zer spreader	25 ft.	25 ft.	25 ft.	.45	Nov
				.15	Dec
Tandem disk	15 ft.	18 ft.	27 ft.	.70	April
				.30	May
Field cultivator	20 ft.	20 ft.	25 ft.	.30	April
				.20	May
Planter	10 ft.	15 ft.	20 ft.	.30	April
				.70	May
Row cultivator	10 ft.	15 ft.	20 ft.	1.00	June
				.40	July
Combine, self-prop.	10 ft.	15 ft.	20 ft.	.50	Sept
				.50	Oct
Tractor	55 h.p.	75 h.p.	120 h.p.		
Tractor	90 h.p.	120 h.p.	160 h.p.		
Two trucks*	.35	.30	.25		Oct
	.35	.30	.25		Nov

*Hours per acre.

Appendix Table 3. Machinery Size and Operations per Acre for Soybeans in Eastern Kansas, 1989

Machine	Machine Size: Small farm	Average farm	Large farm	Times over	Months
Chisel plow	12 ft.	16 ft.	20 ft.	.50	Nov
Moldboard plow	7.5 ft.	9 ft.	10.5 ft.	.50	Nov
Field cultivator	20 ft.	20 ft.	25 ft.	.15	Nov
Tandem disk	15 ft.	18 ft.	27 ft.	1.00	April
Springtooth	18 ft.	18 ft.	24 ft.	.80	May
Planter	10 ft.	15 ft.	20 ft.	.55	May
				.45	June
Rotary hoe	10 ft.	15 ft.	20 ft.	.30	June
Row cultivator	10 ft.	15 ft.	20 ft.	.20	July
Combine, self-prop.	10 ft.	15 ft.	20 ft.	.17	Sept
				.63	Oct
				.20	Nov
Tractor	55 h.p.	75 h.p.	120 h.p.		
Tractor	90 h.p.	120 h.p	160 h.p.		
Two trucks*	.08	.08	.07		Sept
	.32	.29	.26		Oct
	.10	.09	.08		Nov

*Hours per acre.

Appendix Table 4. Machinery Size and Operations per Acre for Grain Sorghum Eastern Kansas, 1989

Machine	Machine Size: Small farm	Average farm	Large farm	Times over	Months
Chisel plow	12 ft.	16 ft.	20 ft.	.50	Nov
Moldboard plow	7.5 ft.	9 ft.	10.5 ft.	.35	April
				.15	Nov
Field Cultivator	20 ft.	20 ft.	25 ft.	.60	April
				.40	May
Tandem disk	15 ft.	18 ft.	27 ft.	.50	April
				.50	May
				.50	Nov
Planter	10 ft.	15 ft.	20 ft.	.30	May
				.70	June
Rotary hoe	10 ft.	15 ft.	20 ft.	.30	June
Row cultivator	10 ft.	15 ft.	20 ft.	.50	June
Combine, self-prop.	10 ft.	15 ft.	20 ft.	.60	Sept
				.40	Oct
Tractor	55 h.p.	75 h.p.	120 h.p.		
Tractor	90 h.p.	120 h.p.	160 h.p.		
Two trucks*	.30	.28	.23		Sept
	.20	.18	.15		Oct

*Hours per acre.

Appendix Table 5. Machinery Size and Operations per Acre for Oats in Eastern Kansas, 1989

Machine	Machine Size: Small farm	Machine Size: Average farm	Machine Size: Large farm	Times over	Months
Moldboard plow	7.5 ft.	9 ft.	10.5 ft.	.60	Nov
Field cultivator	20 ft.	20 ft.	25 ft.	.40	Nov
Tandem disk	12 ft.	18 ft.	27 ft.	1.00	Feb
				.50	March
Springtooth	18 ft.	18 ft.	24 ft.	.40	March
Drill/Fertilizer	13 ft.	18 ft.	26 ft.	.50	Feb
				.50	March
Combine, self-prop.	16 ft.	18 ft.	20 ft.	1.00	June
Tractor	55 h.p.	75 h.p.	120 h.p.		
Tractor	90 h.p.	120 h.p.	160 h.p.		
Two trucks*	.40	.38	.36		June

*Hours per acre.

Appendix Table 6. Machinery Size and Operations per Acre for Sorghum Silage Eastern Kansas, 1989

Machine	Machine Size: Small farm	Average farm	Large farm	Times over	Months
Chisel plow	12 ft.	16 ft.	20 ft.	.50	Nov
Moldboard plow	7.5 ft.	9 ft.	10.5 ft.	.35	April
				.15	Nov
Tandem disk	15 ft.	18 ft.	27 ft.	.50	April
				.50	May
				.50	Nov
Springtooth	18 ft.	18 ft.	24 ft.	.50	May
Planter	10 ft.	15 ft.	20 ft.	.30	May
				.70	June
Row cultivator	10 ft.	15 ft.	20 ft.	.70	July
Silage cutter	6 ft.	6 ft.	6 ft.	.25	Sept
				.75	Oct
Tractor	55 h.p.	75 h.p.	120 h.p.		
Tractor	90 h.p.	120 h.p.	160 h.p.		
Silage packer* (small tractor)	.20	.20	.20		Sept
	.55	.55	.55		Oct
Three trucks*	.55	.55	.55		Sept
	1.60	1.60	1.60		Oct

*Hours per acre.

Appendix Table 7. Machinery Size and Operations per Acre for Bromegrass Hay Eastern Kansas, 1989

Machine	Machine Size: Small farm	Machine Size: Average farm	Machine Size: Large farm	Times over*	Months
Dry ferti'zer spreader	25 ft.	25 ft.	25 ft.	.25	Jan
				.65	Feb
				.10	Aug
Tandem disk	15 ft.	18 ft.	27 ft.	.10	July
				.10	Aug
Springtooth	18 ft.	18 ft.	24 ft.	.10	Sept
Drill	13 ft.	26 ft.	30 ft.	.10	Sept
Rake	12 ft.	12 ft.	14 ft.	1.00	June
Swather - Self-prop.			14 ft.	1.00	June
Windrower	12 ft.	12 ft.		1.00	June
Baler - PTO	12 ft.	12 ft.	14 ft.	1.00	June
Tractor	55 h.p.	75 h.p.	120 h.p.		
Tractor	90 h.p.	120 h.p.	160 h.p.		
Stacking operations**	1.30	1.30	1.00		June

*Times over for tillage-planting operations represents pro-rated share for a ten-year period.

**Hours per acre.

Appendix Table 8. Machinery Size and Operations per Acre for Alfalfa Hay Eastern Kansas, 1989

Machine	Machine Size: Small farm	Average farm	Large farm	Times over*	Months
Moldboard plow	7.5 ft.	9 ft.	10 ft.	.20	April
Tandem disk	15 ft.	18 ft.	27 ft.	.20	June
				.40	July
Springtooth	18 ft.	18 ft.	24 ft.	.10	July
				.10	Aug
Dry ferti'zer spreader	25 ft.	25 ft.	25 ft.	.20	Aug
Drill	13 ft.	26 ft.	30 ft.	.10	Aug
				.10	Sept
Rake	12 ft.	12 ft.	14 ft.	1.00	June
				1.00	July
				.50	August
				.30	September
Windrower	12 ft.	12 ft.		1.00	June
				1.00	July
				.50	Aug
				.30	Sept
Swather, self-prop.			14 ft.	1.00	June
				1.00	July
				.50	Aug
				.30	Sept
Baler-PTO	12 ft.	12 ft.	14 ft.	1.00	June
				1.00	July
				.50	Aug
				.30	Sept
Tractor	55 h.p.	75 h.p.	120 h.p.		
Tractor	90 h.p.	120 h.p.	160 h.p.		
Stacking operations**	1.30	1.30	1.00		June
	1.30	1.30	1.00		July
	.65	.65	.50		Aug
	.39	.39	.30		Sept

*Times over for tillage-planting operations represents pro-rated share for a 5-year period.

**Hours per acre.