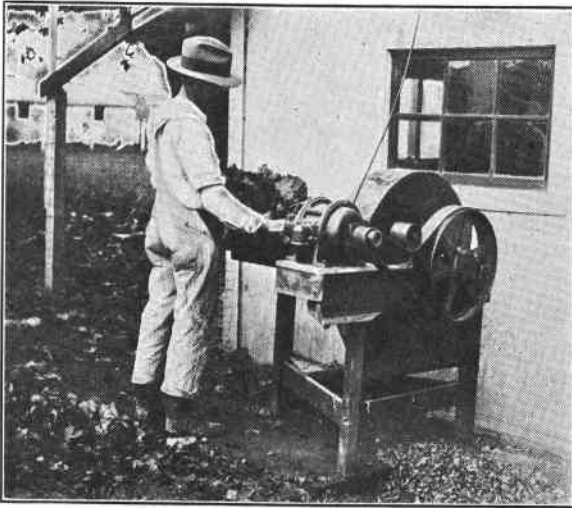


Motor-driven Green Feed, Root, and Straw Choppers



Green feed chopper driven by $\frac{1}{2}$ horse-power motor.

Agricultural Experiment Station
Oregon State Agricultural College
CORVALLIS

SUMMARY

1. Alfalfa and kale must be chopped to lengths of $\frac{1}{2}$ inch or less to avoid waste.
2. Hens eat stems of green alfalfa when chopped but waste the stems if fed unchopped. The midrib of the kale leaf is wasted if not chopped.
3. When a hand-power green feed cutter is operated by a small electric motor the number of pounds cut per hour is increased approximately three times.
4. Cutters having throats up to 10 inches may be operated by a $\frac{1}{2}$ or $\frac{3}{4}$ horse-power motor.
5. Cutters may be run at speeds up to 350 r.p.m. A very satisfactory speed for the larger hand machines is 200 to 250 r.p.m.

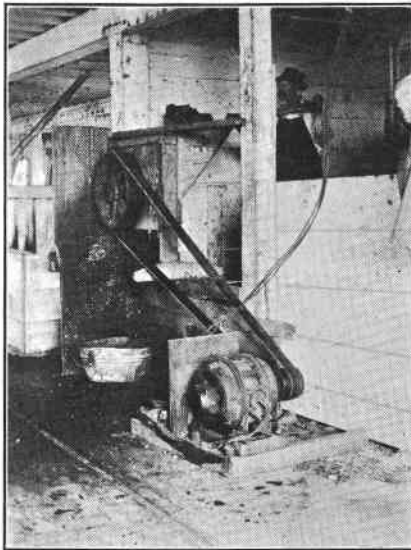


Fig. 1. Motor-driven root cutter used in College beef-cattle barn.

Motor-driven Green Feed, Root, and Straw Choppers¹

By

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Experience has proved that the man in industry or agriculture who supplements his own efforts by the judicious use of power increases his earning capacity.

This is one of a series of publications by the Agricultural Experiment Station issued with the intention of suggesting profit-making and time- and labor-saving uses for power in farming operations. These publications give facts. Every farmer must decide for himself whether a certain piece of equipment has a place in his farming operations. It should be borne in mind that under practically all rate schedules for electric service, the more extensive the use, the lower the rate.

The use for choppers. This circular deals with the small cutters used on poultry or dairy farms for chopping kale and green alfalfa for hens and chicks, roots for hens and cows, straw for chick litter, and small quantities of hay for feeding livestock. These cutters may all be operated either by hand or by power.

Advantages of chopping kale and alfalfa. Tests made by the Poultry Husbandry department show that when green alfalfa is fed unchopped, only the leaves are eaten and the stems are left, whereas when the alfalfa is chopped in lengths of one-half inch or less there is no waste. Since alfalfa runs from 35 to 50 percent leaves and 50 to 65 percent stems, chopping materially reduces the waste.

When kale is fed unchopped, only the thin, tender part of the leaf is eaten and the midrib is wasted, whereas when the kale is chopped to half-inch lengths or less the entire leaf is consumed. By stripping the thin, tender part of kale leaves from the thick center midrib and weighing them separately, it was found that the weight of each lot was the same. Thus by chopping kale for poultry, a waste which may be as great as 50 percent may be entirely eliminated.

Motor vs. hand operation. The use of a motor-driven cutter will save time (see table on page 7) and considerable physical effort. Where time is worth money there is a saving in actual cost by the use of a motor. Under certain conditions, the use of power-driven equipment will enable one person to care for more stock or it may make the employment of additional labor unnecessary. A worker will usually be in a better frame of mind and will accomplish more if his work is not burden-

¹The preparation of this circular and the experimental work upon which it is based have been in cooperation with the Oregon Committee on Electricity in Agriculture. This committee is made up of farmers, business men, and representatives of the State College, Grange, Farmer's Union, public utilities and equipment companies. Its purpose is "to determine and disseminate facts regarding the use of electricity for profit and convenience on Oregon farms."—James T. Jardine, Director, Agricultural Experiment Station; Chairman, Oregon Committee on Electricity in Agriculture.

some. Special attention is called to the comparison between hand and motor power in cutting kale and beets. While there is no meter to register the kilowatt-hours of man power per 100 pounds chopped, the number of pounds cut per hour by man power was approximately one-third that cut by the motor in each case.

Methods of driving the chopper. Four different methods of belting a motor to a chopper have been used successfully by the Experiment Station. Figure 1 shows the method of driving a chopper with a general purpose motor. This method is satisfactory where a motor is used for a number of purposes and where the motor is heavy enough not to need anchoring.

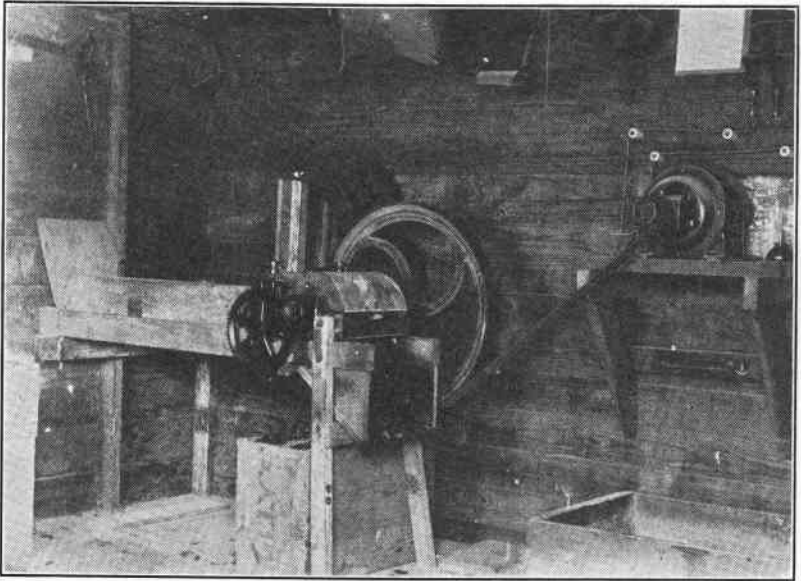


Fig. 2. Motor-driven cutter used on farm of A. G. Lunn.

Figure 2 shows a motor belted to the fly-wheel of a cylinder type chopper. The motor was placed on a shelf to keep it out of the way. Belting to the fly-wheel sometimes solves the problem of speed reduction without the use of an excessively large pulley. This fly-wheel had a 2-inch face. It was not necessary to use a belt tightener.

A fly-wheel type of cutter with a motor supported on the cutter frame is shown in the illustration on the cover. An 18-inch pulley was substituted for the hand crank on this machine. The arrangement is especially convenient where the cutter is to be used in different locations. The motor and cutter are always lined up and ready to run. The pulleys being close together, use of a belt tightener is necessary. The one used on this machine is hinged at the cutter shaft and is heavy enough to tighten the belt by its own weight.

The small hand cutter shown in Fig. 4 is mounted on a plank with the motor under the feed table. Slotted holes in the plank permit sliding

the motor to take up slack in the belt. This cutter is light and easily portable.

Where there is a problem of operating two machines with one motor, they can be so arranged as to use one belt to operate either of them, as shown in Fig. 5.

Where several pieces of equipment are to be run by the same motor, it may be desirable to use a line shaft. This arrangement is shown in Fig. 6, where a feed grinder, a bone grinder, and a green feed chopper are operated by one motor. This is the least desirable method of driving the cutter because of the extra belts, shafting, and pulleys needed and because of the power losses in transmission.

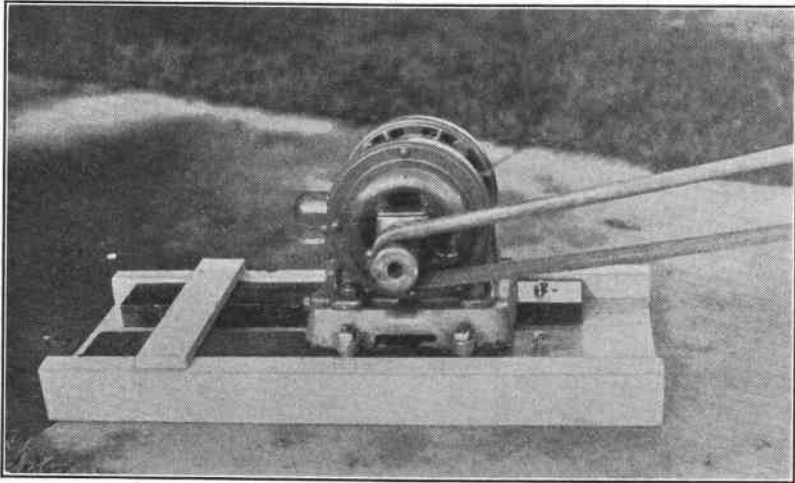


Fig. 3. Method of fastening a small motor so that it may be removed quickly when needed in another location.

Motor may be used for other jobs. The chopper motor may be used for other purposes about the farm. Where it is to be moved frequently, some arrangement should be made so that time is not wasted bolting it down at each change.

This may be accomplished by fastening the motor to two skids (2x4 or 4x4) which are moved with the motor and placed in a frame that constitutes the permanent base for each place the motor is to be used. Figure 3 shows this method, using a motor of $\frac{1}{2}$ horse-power. The permanent base frame is shown in white and the motor and skids are shown in black. The motor and skids may be freed by removing the $\frac{1}{2}$ -inch adjusting pins in front of the motor. By having several holes in the base in line with the holes in the skids for the $\frac{1}{2}$ -inch pins, the position of the motor may be changed, thus providing for belt tightening.

Motor type and size needed. Cutters having throats up to ten inches in width and of either the cylinder or fly-wheel type may be operated at speeds of 200 r.p.m. or more with a $\frac{1}{2}$ to $\frac{3}{4}$ horse-power motor. The small cylinder cutter shown in Fig. 4 operates very satisfactorily with a $\frac{1}{2}$ horse-power motor. Split phase motors (washing machine type) may

be used with these smaller cutters. These are the lowest priced single-phase motors and are not designed for heavy starting loads. They should not be used on the larger-size cutters which turn hard in coming up to speed.

Wiring and starters for motors. Motors of $\frac{1}{2}$ horse-power or less may be operated on a lighting circuit through standard 5-ampere plugs and switches. No special starting switches will be needed. The circuit should be fused with 10-ampere fuses. Larger motors will require special wiring and starting devices.

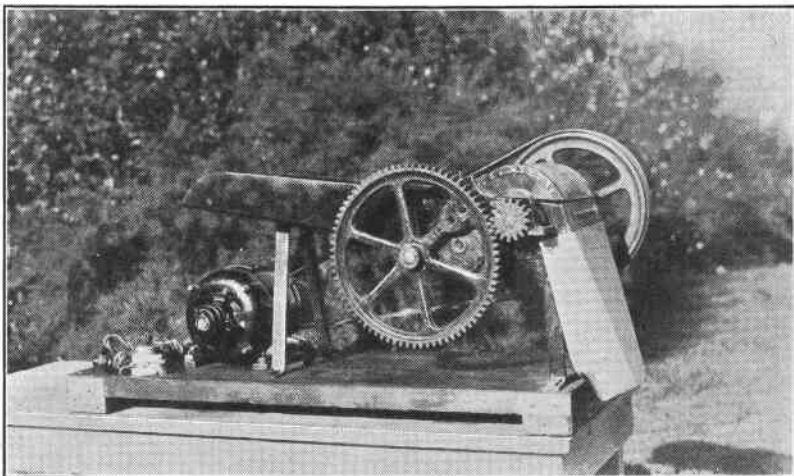


Fig. 4. Small cutter operated by a $\frac{1}{2}$ horse-power motor belted to fly-wheel.

Cutter speeds. Cutters may be run at speeds up to 350 r.p.m. A very satisfactory speed for the larger hand machines is 200 to 250 r.p.m. Cutters should not be driven at speeds much higher than that for which they were designed as there is danger of breakage.

A small cutter (No. 5, Table on page 7) was operated at 600 r.p.m. for the purpose of determining whether a small machine might be operated satisfactorily at high speed. No difficulty was experienced with this machine. We do not recommend running it at that speed until a longer period of operation has demonstrated it to be safe.

Chopping hay. The use of these small cutters for chopping hay is not recommended except where only small quantities are wanted and where other equipment is not justified. They answer very well for cutting what straw litter is needed for baby chicks.

Power consumption. In the accompanying table the kwh per month represents the actual power consumption in chopping for the number of fowls indicated.

The average of the six machines tested required .092 kwh per 100 pounds for cutting kale and the average of the two machines tested on fresh alfalfa required .116 kwh per 100 pounds. The two cutters used in the hay test required an average of .085 kwh per 100 pounds and the power requirement on the one machine tested in cutting roots was .068 kwh per 100 pounds of roots.

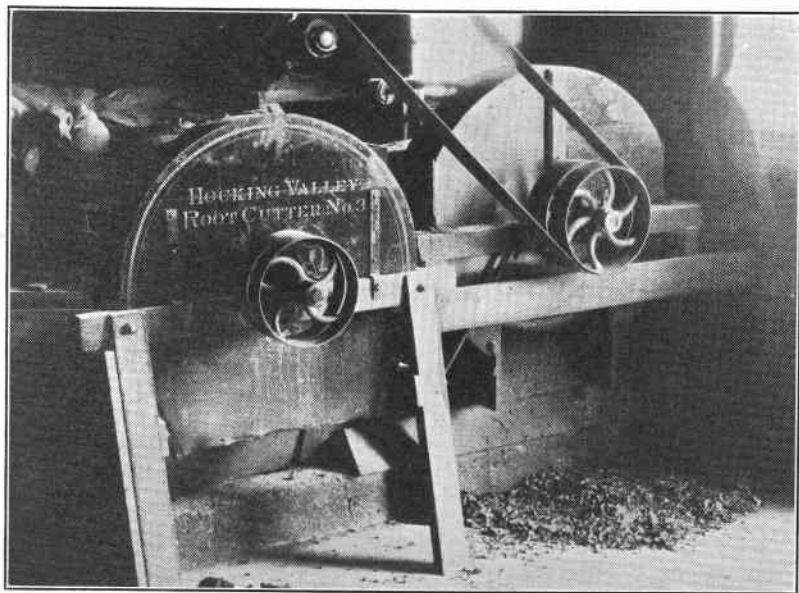


Fig. 5. Root shredder on left and straw and kale cutter on right. Used on farm of L. E. Arnold, Lebanon, Oregon. (See results of tests.)

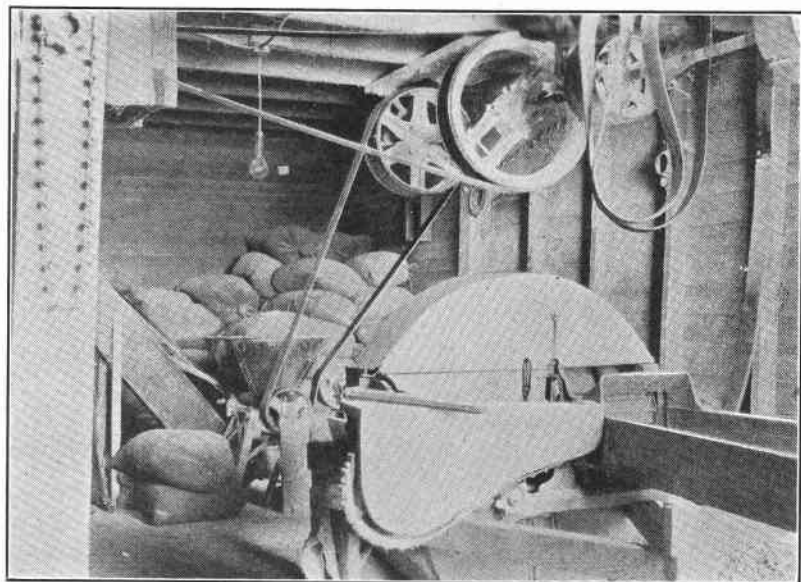


Fig. 6. Feed grinder, bone grinder, green feed chopper driven from a line shaft.

Cutter used	Type	Source of power	Approx. h.p. required	Material cut	Length of cut	Cutter speed r.p.m.	Pounds cut per hr.	No. fowls	Kwh per 100 lbs.	Kwh per mo.
No. 1 (10" throat) (at rt. in Fig. 5).....	Fly-wheel	2 h.p. motor	$\frac{3}{4}$	Kale	$\frac{1}{2}$ in.	200	1130	750	0.071	1.72
No. 2 (7 $\frac{1}{2}$ " throat) (See cover)	Fly-wheel	$\frac{1}{2}$ h.p. motor	$\frac{1}{2}$	Kale	$\frac{3}{8}$	250	960	1000	0.064	1.77
No. 3 (10" throat) (See Fig. 6).....	Fly-wheel	5 h.p. motor	$\frac{3}{4}$	Kale	$\frac{1}{2}$	330	1360	1000	0.091	....
No. 4 (10" throat) (See Fig. 2).....	Cylinder	2 h.p. motor	$\frac{3}{4}$	Kale	1	220	2030	490	0.106	2.5
No. 4 (10" throat).....	Cylinder	<i>By hand</i>	--	Kale	1	....	800	....	....	....
No. 5 (Very small machine) (7" throat) (See Fig. 4).....	Cylinder	$\frac{1}{2}$ h.p. motor	$\frac{1}{2}$	Kale	$\frac{3}{8}$	600	336	....	0.128	....
No. 5 (Very small machine) (7" throat) (See Fig. 4).....	Cylinder	$\frac{1}{2}$ h.p. motor	$\frac{1}{2}$	Alfalfa (fresh).....	$\frac{3}{8}$	600	185	....	0.165	....
No. 2 (7 $\frac{1}{2}$ " throat) (See cover)	Fly-wheel	$\frac{1}{2}$ h.p. motor	$\frac{1}{2}$	Alfalfa (fresh).....	$\frac{3}{8}$	250	858	1000	0.067	1.53
No. 4 (10" throat).....	Cylinder	1 h.p. motor	$\frac{3}{4}$	Hay (Oats and vetch)	$\frac{3}{4}$	190	286	....	0.064	....
No. 3 (10" throat) (See Fig. 6).....	Fly-wheel	5 h.p. motor	$\frac{3}{4}$	Straw	2	330	1650	1000	0.106	....
No. 6 (at left Fig. 5).....	Fly-wheel	2 h.p. motor	--	Beets	--	230	1200	750	0.068	1.22
No. 6 (at left Fig. 5).....	Fly-wheel	<i>By hand</i>	--	Beets .....	--	....	300	....	....	....