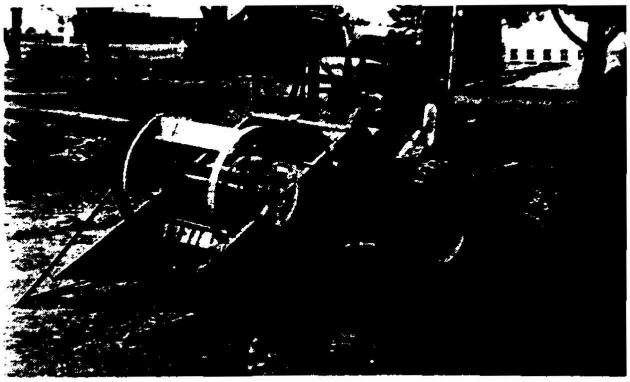

Fig. 2. Alfalfa or grass cutting attachment.

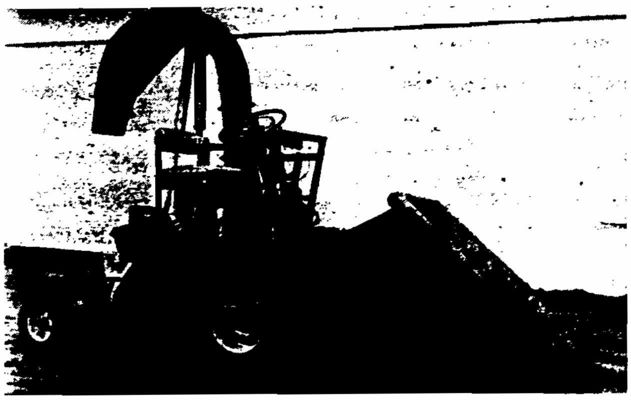

Fig. 3. Corn or sorghum cutting attachment.

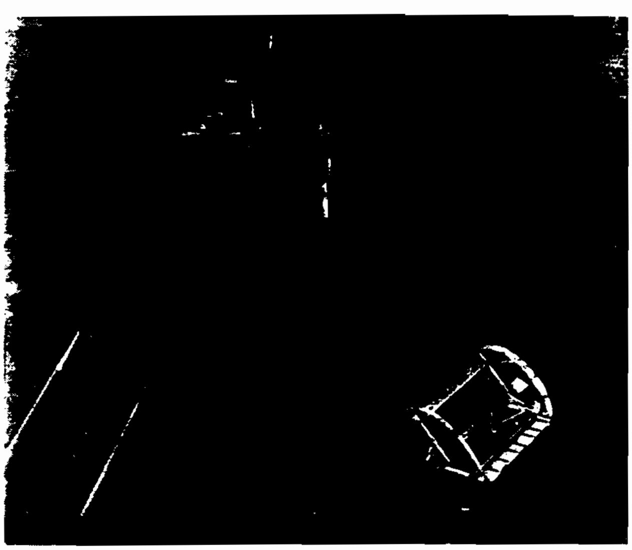

Fig. 4. Power and harvesting units. Note bolts for easy attachment.

to commercial machines. The large engine is a 25-hp V-4 air cooled motor which provides power to the cutter and blower.

The smaller engine provides power to the drive wheels through gear reductions and a 3-speed transmission. One axle from an automobile differential was shortened to provide the narrow tread. Wide base rims and 6:50 × 16 tires provide excellent flotation for the drive wheels. Other parts used to make up this unit were obtained from used automobiles and standard farm machinery.

The weighing container consists of a 0.75-cm (5/16 inch) metal ring sewn in the top of a burlap bag. This ring has a bail 5 cm (2 inches) larger in diameter than the ring sewn in the bag. This arrangement allows the bag to be turned inside out for each plot.

This machine has been successfully used to harvest alfalfa, grass, corn, and forage sorghums. Performance could be improved by using one large engine rather than two smaller ones. In so doing, hydraulic power could be employed to drive the various components. More detailed information is available from the author.

PERCENT SOIL COVER BY SIX VEGETATIVE MULCHES[1]

B. W. Greb[2]

ABSTRACT

Estimates of percent soil cover by straw or stalk type vegetative mulches can be calculated by means of measuring the average length, diameter, and weight of a random sample of clean, oven-dry material. Efficiency of soil cover per unit weight for mulches at Akron, Colo., were spring barley > winter wheat = spring oats > sudangrass > grain millet > grain sorghum.

Additional index words: mulch soil cover.

THE effect of vegetative mulches on soil water, soil temperature, nutrient availability, and soil erodibility has drawn considerable research attention. In terms of vegetative mulch relationships to soil and water conservation, the factors usually considered most important are (i) type of mulch, (ii) weight of mulch per unit area, and (iii) the percent of soil covered by mulches.

Although wheat straw and cornstalk mulches have been used extensively for research, other common types of vegetative mulches such as straws or stalks of barley, oats, millet, and various types of sorghum are available for mulching purposes over large acreages of the United States. Most of the mulch data for interpretation purposes by field conservationists and research technicians have been on a weight per unit area basis. Moreover, an excellent field sampling method for determining the weight of mulches has been successfully used.[3] Recently, however, some of the evaporation and soil temperature phenomena imposed by mulches appear to be better interpreted on the basis of percentage of soil cover rather than on weight.[4] In anticipation of future intensified research with mulches on field plots and lysimeters, a procedure for estimating percent soil cover by a given mulch is needed. One method for determining soil cover by six common types of vegetative mulches grown in the Great Plains is presented here.

Mature straw from winter wheat (*Triticum aestivium* L. 'Warrior'), spring barley (*Hordeum vulgare* L. 'Otis'),

[1] Contribution from the Northern Plains Branch, Soil and Water Conservation Research Division, Agricultural Research Service, USDA, in cooperation with the Colorado Agricultural Experiment Station. Approved by the Director of the Colorado Agricultural Experiment Station as Science Series. Paper No. 1185. Received May 11, 1967.

[2] Research Soil Scientist, USDA, Akron, Colo.

[3] Whitfield, C. J., et al. 1962. A standardized procedure for residue sampling. A committee report. USDA ARS 41:68, p. 3–9.

[4] Greb, B. W. 1966. Effect of surface-applied wheat straw on soil water losses by solar distillation. Soil Sci. Soc. Am. Proc. 30: 786–788.

Table 1. Estimate of soil cover by the average dimensions and weights of six vegetative straws, assuming perfect surface distribution.

Type straw	Mean length, mm*	Mean diameter, mm*	Surface area samples, cm²*	Weight samples, g*	Area/kg straw, m²	Needed for 100% cover, kg/ha
Winter wheat	345	2.5±.1	340	12.4	2.74	3,600±150
Spring barley	268	3.0±.1	320	7.5	4.27	2,300±100
Spring oats	307	3.1±.1	380	13.7	2.77	3,600±100
German millet	248	3.6±.1	350	28.4	1.23	6,100±200
Sudangrass	194	4.1±.2	320	21.6	1.46	6,800-350
Grain sorghum	266	14.8±.5	1,570	259.5	0.61	16,400±550

* Forty clean and oven-dry straws per type.

spring oats (*Avena byzantina* 'Fulton'), sudangrass (*Sorghum vulgare* var. *sudanense* 'Piper'), millet (*Setaria italica* 'German'), and grain sorghum (*Sorghum vulgare*, hybrid 'RS-610') was obtained from field plots at Akron, Colo., late in the fall of 1965. The straw, free from leaf material, was washed clean of dust and oven-dried at 70 C. Under field conditions, grain sorghum produces considerable leaf material, but upon maturity and machine harvesting, most of the leaf material is finely shredded and is blown from fields by wind.

Forty straws were selected at random from the bulk of each of the six processed materials. The width and length of each straw were measured. Then the 40 straws of each mulch were weighed to the nearest 0.1 g. From the information of mean dimensions and weight of the selected straw samples, the area per unit weight that a particular vegetative mulch would cover was calculated.

The measurements obtained from the mean of 40 straws per type of mulch are shown in Table 1. Winter wheat at 2.5±.1 mm had the smallest mean diameter of the six types of straw. Spring barley and spring oats were nearly identical in diameter; however, spring barley straw was considerably lighter in weight than straw from either winter wheat or spring oats. German millet had an average diameter of 0.5 mm less than sudangrass, but was somewhat heavier than sudangrass because of a higher number of solid nodes per unit length. In terms of diameter and weight per area, grain sorghum was much larger than the other mulch materials.

Assuming perfect distribution of straws, the amount of winter wheat, spring barley, and spring oats straw needed for 100% soil cover was 3,600, 2,300, and 3,600 kg/ha, respectively. The high efficiency of spring barley as a mulch is due to a much thinner stem shell. The values for these crops are within normal straw production when grown on fallow in northeastern Colorado.

The average production of German millet, sudangrass, and particularly grain sorghum in the Great Plains is below the quantity needed for 100 percent soil cover. However, the calculated values can be used to estimate percentage of soil cover these types of vegetative mulches would provide under field conditions.

With instrumented small plots and lysimeters, it is recommended that the amount of straw should be increased by 10% to assure 100% soil coverage due to overlapping of straws on the ground.

From the estimate of soil cover by the known weights of the listed vegetative mulches (Table 1), some variation with additional samplings should be anticipated. Different varieties within species and seasonal growing conditions would influence soil coverage efficiency of various types of mulches to some extent. Nevertheless, a reasonable range of mulch coverage expectancy of six common vegetative crops is provided here for use by field conservationists and reasearch technicians.

EFFECT OF SULFUR AND TRACE MINERALS ON FORAGE SORGHUM YIELD AND MINERAL COMPOSITION[1]

D. F. Owen and R. D. Furr[2]

ABSTRACT

Peliminary research indicates that forage sorghum hybrids and varieties differ in nitrogen and mineral contents. Contents of N, P, K, S, Ca, Zn, and Mn varied significantly among varieties. The varieties tested were below the postulated optimum beef cattle requirements for P, Ca, S, and Zn. Chelated minerals and sulfur added to the soil before planting did not affect the yield or mineral composition of the varieties tested.

Additional index words: chelate, ensilage, beef cattle.

SCIENTISTS in animal nutrition have known for many years that forage sorghum (*Sorghum vulgare* Pers.) must be supplemented with minerals for optimum cattle performance. Until recently, high costs for laboratory analysis of plant samples have limited research toward increasing mineral content in forage sorghum. The development of the atomic absorption spectrophotometer and computer analysis programming has made these costs less prohibitive.

This research was initiated to compare the amounts of certain trace elements and certain macronutrients contained in forage sorghum with the postulated optimum requirements for beef cattle nutrition and to study the effects of added trace minerals and sulfur on forage yield and composition.

The experiment was conducted on Pullman silty clay loam soil of medium fertility and pH 7.2. Design was a split-plot with five varieties as main plots and four treatments as subplots. Main plots were two 1-m (40-inch) rows 61 m (200 ft) long. Subplots were 15.2 m (50 ft) long.

Treatments of 44.8 kg sulfur/ha (40 lb/acre), 44.8 kg sulfur/ha + trace minerals, and trace minerals only, were applied with ammonium nitrate (56 kg N/ha) as carrier in bands approximately 10.16 cm (4 inches) to the side and 5.08 cm (2 inches) below the seed. Control plots had only the ammonium nitrate added.

The chelated trace minerals[3] were zinc (14.2% metallic), iron (Sequestrene 138 Fe-6.0% metallic), manganese (12% metallic), and copper (13% metallic). Chelated magnesium (5.5% metallic) was also included. Each mineral was applied at the rate of 2.24 kg chelated material/ha (2 lb/acre). The trace mineral treatment consisted of all the minerals mixed with the ammonium nitrate carrier. Sulfur was prilled elemental sulfur (99.5%). All plots received a preplant application of anhydrous ammonia (179.2 kg N/ha) and two supplemental irrigations.

Samples from 3.96 m (13 ft) of one row of each plot were hand harvested for yield. The samples were weighed and then ground in a field ensilage cutter. Representative samples of ground material were taken from each plot and dried in a forced-air oven at 70 C. After drying, samples

[1] Contribution from the Texas Technological College Research Farm and Kilgore Beef Cattle Center, Pantex, Texas. Published with the approval of the Director of the International Center for Arid and Semi-arid Land Studies as ICASALS Contribution No. 25. Received April 3, 1967.

[2] Former Agronomist and Animal Nutritionist.

[3] Sequestrene Brand furnished by Geigy Chemical Company.