Extruded soybeans for mid-lactation

The dairy cow, like other ruminants, has four compartments in its stomach. The first compartment, the rumen, partially degrades feedstuffs by anaerobic microbial fermentation processes. The fourth compartment, or abomasum, corresponds to the single stomach of nonruminants, where final degradation of ingested material takes place.

Depending on the degree of degradability, dietary protein can be partially or totally degraded into ammonia and used by ruminant microorganisms to synthesize microbial protein. The degree of protein degradability in the rumen depends on inherent feed characteristics, rate of intake and feed passage to the lower digestive tract, and limitations in rumen fermentation processes.

Much of the microbial protein and rumen undegradable feed protein is eventually digested in the lower digestive tract, and the resulting amino acids are used for body

Propagating eucalypts, continued

the desired lining-out containers, generally 1.5-inch-diameter by 8-inch-deep planting tubes. The size of the root system makes smaller tubes difficult to use. A well-drained potting mix (U.C. type) was used. Irrigation included a complete, half-strength fertilizer solution.

After another two weeks, the cuttings were moved outdoors, usually to a lathhouse or to an unshaded greenhouse bench, where they remained until planting out. Growth was rapid in the tubes; in the March-to-October interval in Davis, rooted cuttings were ready for planting out within three months after sticking.

High rooting percentages have been obtained on cuttings taken from plants during March to November. When eucalyptus plants are maintained in heated greenhouses during the winter, cuttings are available year-round. But insect and disease (mildews) problems have occurred on the mother plants, with lower rooting percentages on the cuttings taken from these plants. Research is continuing on year-round production and rooting of leafy softwood cuttings; for the present, however, cuttings are made from spring to fall.

For all selections tested, rooting percentages have been high with cuttings from hedged mother plants up to 18 months old, some with flowers and fruit. At least an eight-fold increase in plant number per growing shoot can be expected in the mother block during a six-month period of rapid growth.

Future research

The red gum clones developed are not necessarily the best trees for energy plantations. They are fast growing (seedling plantations yielded about 15 dry tons per acre in a 2-year cycle), but we do not know that they will produce the maximum biomass yields in high-density plantations with 3- to 5-year harvest cycles over a 25- to 50-year lifetime. Nevertheless, these clones will provide base yield data for comparison with seedling plantations and with other fast-growing clones selected in the future. Our current goals for intensively managed energy plantations are approximately 15 tons (7 to 8 cords) oven-dried matter per acre per year.

Clones of low-temperature-tolerant eucalyptus species and hybrids with high growth rates are being propagated by relatively expensive tissue-culture techniques in several laboratories. Recently, procedures for rooting stem cuttings have been developed for these clones, which should make them economically feasible for energy (timber, pulp, fuel wood) plantations in the low-temperature regions of California.

Direct sticking of stem pieces in the field is practiced with hardwood cuttings of poplar and willow species. If this can be done with indolebutyric-acid-treated leafy cuttings from some fast-rooting eucalyptus species at certain times of the year, propagation and planting costs can be significantly reduced. High initial investment cost is an important factor limiting development of fuel wood plantations.

Mist propagation with relatively large droplet size and residual water and leaf surfaces may not be the best method for rooting eucalyptus cuttings; disease and leaching problems are apparent in some species. Other authors report better success with high humidity chambers equipped with fogging-type nozzles. These will be tested at Davis.

Mother block maintenance and renewal to maximize annual cutting production for plants maintained outdoors is not sufficiently well known to make definitive recommendations. Hedgerows would appear to be satisfactory, but it is not known how long high rooting percentages can be maintained.

A list of commercial nurseries selling these plants under the trade names of C-1, C-2, CR-1, CR-2 is available through the Department of Environmental Horticulture, University of California, Davis, CA 95616.

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Holsteins milked 3X daily

Thomas A. Shultz

maintenance and milk synthesis. Moderate milk production can be obtained from rumen microbial protein sources alone; higher milk yields have been reached in some instances by increasing the amount of dietary protein that bypasses rumen degradation. Researchers at the University of California and South Dakota State University have observed improved milk yields in high-production cows during early lactation by increasing diet bypass protein, whereas observations at the University of Alabama and Pennsylvania State University showed no benefit for lower production cows or for early-lactation cows fed a high level of bypass protein.

Information is scarce on the feeding of bypass protein to mid-lactation cows subjected to the added stress of being milked three times daily. The objective of this experiment was to study the effects of replacing the most common protein supplement on California dairies, whole cottonseed, with a known bypass protein source such as heat-treated extruded whole soybeans.

We divided 130 Holstein cows, two-thirds of which were second-calf animals, into two equal groups placed in two adjacent corrals by expected lactation performance and days in milk. One group received a control ration of alfalfa hay, corn silage, alfalfa silage, and concentrate ingredients. The experimental group received a similar ration, but two-thirds of the whole cottonseed was replaced with extruded whole soybeans. The concentrate mixes were formulated to be isonitrogenous, isocaloric, and similar in fiber content by adjusting proportions of dried beet pulp, almond hulls, barley, whole cottonseed, and extruded whole soybeans (table 1).

Silage and supplements were mixed and fed in equal portions three times daily and alfalfa hay was fed separately twice daily. Feeds were chemically analyzed at the start, middle, and end of the experiment with the average analysis also listed in table 1. Rations were offered at the rate of 58 pounds of dry matter per cow daily, allowing 10 percent for wastage. Feed refusals were removed twice daily and fed to heifers not in the feeding trial.

The cows were milked three times daily; milk weights were recorded daily for 45 days, and milk tested for fat and solids-not-fat at days 15 and 45 of the experiment. Both groups received the control ration before the experiment. The cows were housed in free-stall, roofed, open-sided facilities in the southern San Joaquin Valley of central California.

Analysis of the milk production and composition data showed no significant differences between the two feed groups during the third through seventh or more months of lactation (table 2). The more frequent feeding schedule used in this three-times-daily milking operation and the natural bypass protein of feedstuffs utilized in this trial are possible reasons for the absence of appreciable differences between feed groups. These results indicate that the nutrient requirements for this level of production were met equally by the two diets.

Economic analysis of the feed costs at the time of the observations indicated that an increased milk yield of 4 pounds per cow daily would be needed to recover the extra cost of including extruded whole soybeans in the ration. The assumed feed intake and observed milk yield in this trial did not substantiate their inclusion.

In summary, the trial results support the general guideline that including extruded whole soybeans in the rations of mid- and late-lactation cows does not increase milk production, regardless of whether the cows are milked twice or three times daily.

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TABLE 1. Ingredients and compositions of feeds

Parameter	Experimental groups: Control ration	Experimental groups: Extruded whole soybeans
Ingredients	*% of dry matter*	
Alfalfa hay	27.4	27.4
Alfalfa silage	8.2	8.2
Corn silage	6.1	6.1
Whole cottonseed	12.0	2.5
Almond hulls	6.8	5.5
Dried beet pulp	10.3	14.6
Mineral pellet	8.6	8.6
Rolled barley	20.6	21.1
Extruded whole soybeans	***	6.0
	100.0	100.0
Composition*		
Crude protein, %	16.2	16.5
Crude fiber, %	15.9	15.5
Net energy for lactation†	0.75	0.74

* Average analyses of ration samples taken at the start, mid and end of experiment.
† Megacalories per pound

TABLE 2. Milk yields and composition by month of lactation*

Item	Experimental group	Month of lactation: 3	4	5	6	7
Days in milk	Control ration	85±12	118±10	152±7	176±11	267±26
	Extruded whole soybeans	90±9	115±9	149±7	178±9	254±21
Daily milk, lb	Control ration	79.5±15.3	75.7±14.1	71.5±13.2	62.2±25.3	58.2±8.7
	Extruded whole soybeans	80.6±14.1	75.9±17.2	69.2±13.9	60.2±9.5	56.9±10.4
Milk fat, %	Control ration	3.80±.63	3.68±.61	3.70±.45	3.74±.56	3.99±.54
	Extruded whole soybeans	3.57±.53	3.54±.35	3.80±.33	3.88±.50	3.96±.51
Solids-not-fat, %	Control ration	9.10±.33	9.06±.36	8.91±.38	8.95±.31	8.99±.24
	Extruded whole soybeans	8.99±.46	8.94±.29	9.04±.24	8.97±.27	8.98±.48
Daily 3.5% FCM, lb†	Control ration	83.1±14.7	76.9±11.4	73.7±13.3	63.9±13.5	62.2±8.7
	Extruded whole soybeans	81.3±16.6	76.1±16.1	72.6±13.6	63.6±9.6	60.9±11.3

* Average ± standard deviation.
† Milk corrected to 3.5% milk fat basis.