variation rendered the differences statistically nonsignificant. Yield differences in 1969 increased to 258 per cent under the same conditions. This difference from the 1968 values was attributed to the fact that the 1968 flower buds had probably been injured during setting in the fall of 1967 (or in 1968 before the treatments began) while the 1969 buds had been protected in 1968. Typical yields of grapes from single vines are shown in the photos.

Zinfandel grapes dusted twice during the 1967 season with N,N'-diphenyl-p-phenylenediamine (DPPD) showed an average increase in yield of about 20 per cent but the variation was too great for statistical validity. A similar study in 1968 showed no differences. The dust may have been washed from the leaves by unseasonal rains in 1968.

Spraying

In 1969, 103 comparable grapevines were separated randomly into two groups of 50 and 53 vines each. Fifty of the vines received three spraying each (5/23, 6/12 and 7/15) with 1.5 g "active" DPPD/vine formulated in a citrus storage wax emulsion. Where the emulsion collected and dried in heavy deposits, the leaves remained greener than the surrounding leaf tissue. The grapes were picked from these vines September 16, 1969. Yield from untreated vines averaged 3.88 kg while the sprayed vines yielded 4.87 kg (table 6). These differences were statistically valid at the 1 per cent level.

As suspected from previous studies, and from obvious leaf injury symptoms in current studies, grape varieties which suffered extensive leaf injury from photochemical smog produced fewer grapes of lower quality (based on sugar content). Destruction of chlorophyll and possibly other biochemical effects of the air pollutants seemed to be impoverishing the plant. Prevention of at least part of this loss seems to be a distinct possibility—if the conditions for application of effective antioxidants can be determined.

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RICE STRAW UTILIZATION BY LIVESTOCK

W. J. CLAWSON · W. N. GARRETT

Population pressures, plus the increased awareness of the need for environmental improvement, are limiting the use of burning as a method for disposing of all agricultural wastes, and rice straw is no exception. Producers are actively seeking alternate methods for disposal, or use, of the four tons of straw produced per acre on an average rice field in California. The summary reported here is from a detailed study of literature on the utilization of rice straw by livestock (available from local Farm Advisors as Agricultural Extension Service Publication MA–1). Further studies are in progress.

UNSUPPLEMENTED RICE STRAW is too low in digestible energy, crude protein, calcium and phosphorus to be used as the only source of nutrients for beef cows or growing cattle (see table for comparison with alfalfa hay). Rice straw is apparently also low in cobalt, copper, magnesium and sulfur, with the possibility of borderline deficiencies for these minerals. Additional analyses are needed, particularly for iron and zinc, to give a more complete picture for the nutritionally essential minerals.

Mixture

From data in the table it can be calculated that a mixture of approximately 60 per cent rice straw, 10 per cent cottonseed meal and 30 per cent barley would have the digestible energy and protein necessary for a beef cow nursing a calf, and for a growing beef steer to gain 1 to 1.5 lbs/day. In addition, .25 to .50 lb of trace mineral salt and .5 lb of limestone or oyster shell flour (cottonseed meal and barley will supply adequate phosphorus) per 100 lb of the mixture should be added to eliminate the possibility of mineral deficiencies. For dry pregnant cows, a mixture of 80 per cent rice straw, 4 per cent cottonseed meal and 16 per cent barley—along with the .25 to .5 lb of trace mineral salt and .2 lb of dicalcium phosphate or bonemeal per 100 lb of the ration—would meet nutrient requirements.

Using current prices it is estimated that rice straw has a value of about 35

MAJOR NUTRIENT VALUE COMPARISON OF TYPICAL RICE STRAW WITH AVERAGE ALFALFA HAY FOR REQUIREMENTS OF PREGNANT MATURE BEEF COWS OR GROWING STEER CALVES

	TYPICAL COMPOSITION		REQUIREMENTS	
	Rice straw	Alfalfa	Cows with calves	Growing steers
Digestible energy, mcal/kg.	1.9	2.5	2.5	2.5
Crude protein, %	4.5	17.0	9.2	10.0
Ether extract, %	1.5	2.0	—	—
Crude fiber, %	35.0	27 0	—	—
Lignin, %	4.5	6.5	—	—
Cellulose, %	34.0	24.0	—	—
Nitrogen-free extract, %	42.0	40.0	—	—
TDN	43.0	57.0	57.0	57.0
Ash, %	16.5	10.0	—	—
Silica, %	14.0	1.5	—	—
Ca, %	0.19	1.3	.28	.25
Co, mg/kg.	.05	.09	.07	.07
Cu, mg/kg.	5.0	14.0	4.0	4.0
K, %	1.2	1.5	.7	.7
Mg, %	.11	.33	.1	.1
Mn, mg/kg.	400	30	20	10
P, %	.10	.23	.22	.20
S, %	.10	.3	.1	.1

per cent of alfalfa hay when fed to growing beef steers or lactating beef cows, and 50 per cent of the value of alfalfa hay when fed to a dry pregnant beef cow.

The literature indicates a very strong possibility that the feeding value of rice straw (at least the available energy content) can be markedly improved by treating the straw with alkali. In some trials the energy value was increased to a level above alfalfa hay. This treatment, of course, does not increase the protein or calcium and phosphorus content. Supplementing these nutrients would be necessary even if energy digestibility was increased.

There are some aspects of the composition of rice straw that are evidently different from most other roughages. On the negative side, the high silica content (average 14 per cent) probably interferes with the utilization of other nutrients and is of no nutritive value. On the plus side, there is a relatively low lignin content and a more digestible crude fiber fraction than is found in other straws and in most average quality hays. The cellulose content is high and since pure cellulose is readily fermented by rumen bacteria (if the molecules are accessible to their enzymes). This fraction has the potential to furnish a substantial amount of energy to the ruminant. The nitrogen-free extract fraction, however, appears to be less well utilized than would be predicted from studies with other roughages.

Poor quality

At the present state of knowledge, it can be concluded that untreated rice straw is poor quality roughage that needs to be fed with supplemental protein, phosphorus, calcium and possibly some trace minerals before it is a suitable feed for even the maintenance of ruminant livestock. For animals at relatively low levels of production—slower growth of steers and heifers or for feeding pregnant or lactating beef cows—some additional source of available energy is also required. Treatment of the straw with small quantities of sodium hydroxide shows great promise as a means of increasing the digestibility of the fraction capable of supplying the ruminant with energy, but the mechanisms and the economics associated with alkali treatment remain to be determined.

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STREPTOMYCIN in California

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Streptomycin was registered for use in controlling fireblight of pome fruit on the West Coast prior to 1968, however, application was restricted to no later than 90 days before harvest; and cancellation of this use had been under consideration because of insufficient residue data.

Pear growers in California and University researchers were concerned that the use limitations (especially on pears) were too restrictive for current fireblight conditions. Much of this blight appears on pears in mid-June and July—which in some areas of the state is 15 to 30 days before harvest. One major cause for concern has been the possibility that streptomycin might be completely cancelled for use on pears—a severe financial threat to pear growers because of their frequent, heavy losses of fruit-bearing wood and entire trees due to fireblight.

Other factors

Two other factors concerned many growers, researchers, and agribusinessmen. First, the grower who shipped his pears to the fresh market, as opposed to the cannery, frequently encountered rather severe pear russetting when he used the old standby copper-control methods. However, no such russetting was observed on Bartlett pears in California when streptomycin wettable powder (WP) or dust formulations were used. Secondly, there was concern that the two major manufacturers of agricultural streptomycin might not choose to conduct the research necessary to maintain or improve streptomycin's registration status, because of its relatively limited market.

University researchers needed additional efficacy and residue data to support a recommendation in compliance with U.C.'s pesticide policy.

With the wide variation in application rates and methods brought about by semi-concentrate and concentrate spraying, it also became apparent that streptomycin should be recommended on the basis of total amount of active ingredient in ounces per acre per application (oz/A), rather than in parts per million (ppm). This decision was made because growers were frequently confused and in doubt as to how much material an acre they could legally apply—in relation to the age, size, and number of trees per acre.

1968 field experiments

Field experiments were set up by U.C. researchers to study various formulations and application methods, to collect residue data, and to change ppm ratios to the more understandable active ingredient equivalents. The ultimate goal was to shorten the time limitation on application before harvest from 90 days to a more realistic schedule.

Large-scale field plots were set up in three major northern California pear-growing counties: Mendocino, a coastal county; Lake, an inland mountain county; and Yuba, a Sacramento Valley county.

Streptomycin WP as a 17 per cent active ingredient formulation was used at 4 oz/100 gal, equivalent to a 50 ppm concentration. Three different types of applications were made in the plots. All applications were made at weekly intervals, a total of 17 applications per plot for the season. In full-gallonage (600 gal/A) hand-gun plots, streptomycin WP was used at 4.8 oz/100 gal, equivalent to a 60-ppm concentration. In semi-concentrate (90 gal/A) conventional air-blast speed-sprayer plots, applications of 6.0 oz to 12.0 oz streptomycin (approximately 75 to 150 ppm) were used. In concentrate plots (4 gal/A), using an Econ-O-Mist applicator, 6.0 oz and 12.0 oz streptomycin rates were applied, equivalent to spray-tank concentrations of 1,875 and 3,750 ppm. Although these were extremely high spray-tank concentrations, the amount of active ingredient