Cropping for Silage in Semi-Arid Areas of Queensland

By P. J. SKERMAN*†

QUEENSLAND'S woolgrowing area is contained largely within the 10 and 20 inch isohyets stretching from the N.S.W. border in a N.W. direction through the centre of the State to just north of the Hughenden to Cloncurry railway. A final swing S.W. from Cloncurry encompasses what are known as the Boulia sheep lands. The southern third of the region is made up of "traprock" country just west of Warwick, flooded Coolibah **(E. microtheca)** plains in the Goondiwindi to Talwood, Dirranbandi and Cunnamulla areas, old alluvial brigalow **(Acacia harpophylla)** and box **(E. populnea)** plains just north of these areas and a vast mulga **(A. aneura)** belt extending westwards and north westerly from St. George to Augathella, Adavale and Windorah, with occasional patches of downs country. These areas devoted to wool-growing are considered to be reasonably safe because in addition to the normal summer monsoonal rains appreciable winter rainfall is likely to fall. Furthermore, edible shrubs, particularly the mulga, renders them reasonably free from heavy drought losses.

The northern two thirds of the area, however, stretching from Augathella to the Flinder's flood plain in the Gulf, comprises mainly heavy soil Mitchell and Flinders grass downs. In normal seasons these downs properties are excellent woolgrowing areas, the main diet of the sheep being, however, not so much the comparatively drought-resistant Mitchell grasses but an ephemeral gramineous and herbaceous flora of Flinders **(Iseilema spp),** button **(Dactyloctenium radulans),** spider couch **(Brachyachne convergens),** tar vine **(Boerhavia diffusa),** some annual Chenopods and a sparse sprinkling of legumes such as **Rhynchosia minima, Glycine spp** and **Psoralea spp.** The usual carrying capacity is one sheep to three to five acres. In a year of severe drought, however, the ephemerals do not appear, the Mitchell grass is severely grazed and in the absence of "top feed" heavy losses of sheep occur. The usual measures for drought relief include the purchase of sheep nuts or maize grain for drought feeding or shifting of stock to agistment areas. The latter are difficult to obtain in a year of general drought. The so-called "desert" country east of Aramac and Blackall, consisting of sandy lateritic soils carrying "spinifex" **(Triodia spp),** desert blue grass **(Dichanthium ewartiana)** in more favoured localities and **Aristida spp.** is used to some extent but provides poor grazing.

From every analysis of the causes of variations in sheep numbers throughout the State, the fact emerges that drought is the chief hazard. Queensland sheep numbers dropped from a record 26,290,860 in 1942 to 16,164,000 in 1952 - a drop of 10 million sheep as a result of two severe droughts in 1946 and 1951-2.

In an attempt to mitigate drought losses throughout this Mitchell grass downs area the Queensland University has begun investigations into crop growing for fodder conservation. Conservation of summer fodders such as sweet sorghums in the form of silage offers the best chance of success because the rainfall is typically a low pressure summer monsoonal type and to utilise it most effectively a quick maturing summer crop of reasonable bulk is required. Harvesting for silage occurs about a month earlier than a grain harvest and thus less soil moisture is required. Furthermore, silage is succulent, and is bird, rat and fireproof - all important considerations in far western areas. Practically all attempts at growing grain crops have been frustrated by the depredations of galahs **(Kakatoe rosei-capilla)** and corellas **(K. sanguinea and K. tenuirostris).**

The soils throughout the area belong to Prescott's group of "grey and brown" soils of heavy texture. They are heavy, self-mulching clays varying in depth from 2 ft. 6 in. to five feet, overlying Cretaceous sands, sandstones and shales. The clay content is of the order of 50 to 60 per cent. and the soils are capable of good moisture storage. The field capacity is about 29 per cent. and the wilting point 17 per cent.

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Preliminary fertility trials, using Anderson's 'shot gun' mixture of major and minor elements, has shown these soils to be well supplied with all except nitrogen. The available phosphate content generally lies between 120 and 200 p.p.m. (a figure of 50 p.p.m. has been taken as the critical point in phosphate availability).

The rainfall from November to March averages 14 inches at Richmond, thirteen at Blackall, eleven at Muttaburra, and 10½ at Charleville — the sites of the University experimental plots.

The average annual fall is 19, 20, 17 and 19 inches respectively. The bulk of the rain, therefore, talls during the growing period of the crop. The opening rains vary in incidence and may occur from October or may be as late as early March, as occurred in the Richmond area in 1955. With a good spread of planting rains it is possible to stagger the plantings to give a better distribution of harvest labour. The areas from Muttaburra north are relatively frost free and so later plantings can be made than in the frost-liable southern areas. In the northern areas sorghum growth continues through the winter, though at a reduced rate, while soil moisture is adequate so that green material either in the original crop or as a ration can be stood over for use in the drier August to October period. Preliminary tests of soil moisture requirements in 1954, indicated that during the 74 days' growing period at Muttaburra, some 8.5 inches of water were actually used to grow the crop. The 1955 figures gave little information because of the exceptionally heavy rainfall of from eleven to twenty-two inches during the growing period. In many years this moisture requirement will be supplied by the current season's rainfall, but to improve cropping prospects a year's fallow is being recommended. The moisture stored during the fallow, plus the current season's rainfall, will give a crop in most years. In addition, it has been found that these heavy soils can build up an appreciable supply of nitrate nitrogen during this fallowing period so that the two chief hazards to crop-growing — lack of soil moisture and available nitrogen — can be practically eliminated by fallowing.

The yields so far obtained varied from 3 tons per acre to a maximum of 24 tons per acre for a crop of certified Saccaline, grown on a long fallow. Five varieties of sweet sorghum — Saccaline, Early Orange, White African, Sugar Drip and Italian — have been grown along with Sudan grass in variety trials. There appears to be little significant differences in yields among the sweet sorghums, but each is significantly better than Sudan grass. The Italian variety is a fortnight earlier than the other sorghums and this helps to spread the harvest over a longer period.

Row spacings at 14 inches and seed planting at 8 lb. per acre have given best results. The cutter-bar forage harvester has been adopted for harvesting, the whole unit comprising a tractor (usually of a crawler type), a forage harvester and a following trailer. Present forage harvesters will only cut a 4 ft. face and there is need for a wider cutting machine when large acreages are being harvested. Trailers have been adapted for side-tipping to discharge their loads into the silage trenches and subsequent spreading and compression of the material has been carried out with a crawler tractor fitted with a dozer blade. Heavy rear tipping trucks with dual wheels and four wheel drive have been satisfactorily driven through the trenches, but the single-wheel vehicles usually bog in the silage.

No additives have been added to the silage as the sugar content of the sorghums is high and fermentation proceeds satisfactorily. The trenches so far used have been of about 100 ton capacity and after filling are topped off with 2 ft. of soil to provide a good camber for shedding rainfall.

The silage resulting from ensiling sorghums have yielded protein figures of 4 to 10 per cent., with the majority around the 6-7 per cent. mark. This lower protein percentage is a little low for maintenance of sheep and Moule (1954) found in feeding trials that 3 lb. of silage and 1 oz. of protein meal were required for maintenance. With lambing ewes a satisfactory ration consisted of 4 lb. of silage plus 4 oz. of protein meal. In a subsequent trial by Ewer (1955), using silage of 10 per cent. protein, 3½ lb. of silage alone gave an increased live weight yield over a short duration trial.

In an endeavour to eliminate the purchase of high protein concentrates experiments have been conducted with sorghum interplanted with legumes. Some thirty-two legume varieties were used last season and of these Mung bean **(Phaseolus aureus), Phaseolus mungo,** Reeves and Cristaudo cowpeas, and **Dolichos sp.** were the most promising. The protein content of the legumes varied from 8.4 to 14.2 per cent. on a moisture free basis and the presence of the legume lifted the protein level of the mixed material. It is hoped to ascertain the best legume-sorghum mixture in the next season's trials.

Some of the legumes matured well ahead of the sorghum and these may have a place for grain production in place of maize grain, being picked from the ground by sheep during drought periods. Experiments with a number of these grain legumes will be initiated this season.

The protein content of sorghum grown on a long fallow was some 30 per cent. higher than that grown without fallow. Hence fallowing has a three-fold advantage, in that it provides greater soil moisture, more nitrate nitrogen and a material of higher quality.

The cost of silage produced on Western Queensland properties has ranged from 25/- to 35/- per ton in the trenches. Costs have varied considerably with the varying purchase of plant. A total capital outlay of £6,000 to £ 12,000 has been involved. Costs have been compiled, taking into account interest on capital outlay, depreciation and repairs. The reliability of cropping is not included and allowance for a failure once in 2, 3 or 5 years would increase costs accordingly. However, in comparison with purchased fodders the cost of silage is extremely low. Freight charges, even on a rebate basis of fodder for starving stock, are heavy, e.g., for one property it is £ 1 1/16/6 per ton ex Brisbane. Road transport costs are generally superimposed upon rail freights as most properties must inevitably be removed from the railhead.

To date some fourteen grazing properties in the under 20 inch rainfall belt have conserved silage to the extent of some 27,500 tons in storage. According to the basic ration used, this amount would feed some 50,000-75,000 sheep each day for a full year's drought.

Excavation and distribution of the silage for drought feeding still remain to be investigated. For reasonably small feeding lots an end loader will excavate sufficient material. An American excavator, the "Ensiloader", will excavate half a ton of silage per minute and efforts are being made to introduce this machine or have a similar one built locally.

The distribution in the field is another problem. It is thought that heaps distributed twice or three times weekly would be more economical than daily distribution in troughing.

DISCUSSION

Dr. FRANKLIN: Mr. Skerman is to be congratulated on the excellent work he is pioneering in Queensland. This work on silage production is indicating ways and means of conserving fodder cheaply and storing it in a form which will not suffer undue deterioration over a long period.

Mr. Skerman referred to the serious loss in the sheep population of Queensland in the 1945-46 drought. Losses, of course, were not confined to Queensland only — they were Australia wide. During that period Australia lost 27.5m. sheep and nearly 10 years elapsed before Australia's sheep population recovered to the 1943-44 level. In terms of value of wool, based on actual average wool prices, the gross loss over this 10 year period amounts to £6,000,000,000.

Mr HILDER: According to percentage nitrogen of the silage product and the quoted yields of 24 tons per acre, the removal of nitrogen in the stored product is very high. Are any precautions taken at the moment to see that the material removed is fed back on to the area from which it came?

ANS.: So far the seasons have been bounteous and the necessity for large scale feeding has not arisen. To date only experimental sheep have been fed. The general scheme is to put pits close to the paddocks being cropped to facilitate operations and it would follow that stock would be brought as close to the pits as feasible for feeding. Water provision may present a problem where sheep have to be brought in. Sheep will not eat the thick stalks, so there is a return of materials in waste. It is necessary to feed in small groups — additional fencing is required — general management conditions would tend to cut across any question of large scale cropping.

Mr. WARD: What effect would the areas required for cropping have on the overall carrying capacity of the properties?

ANS.: Properties concerned are large and the areas required for cultivation do not have any really significant effect. Requirements can be estimated on the basis of 1% tons/ 1,000 sheep. Young sheep only are saved in major droughts, so that feeding would be concentrated on this group.

Prof. McCLYMONT: Could Mr. Moule tell me the dry matter content of the silage, and its estimated starch equivalent, whether any comparison has been made of high energy and high protein supplements for the silage when fed at maintenance or sub-maintenance levels, and whether the sheep maintained weight on the diets? My own rough calculations suggest that at the levels of silage fed, a specific response to a protein supplement would not be expected due to the low energy intake.

ANS.: Silage is basically deficient in protein — different amounts of silage were fed in trial with and without protein supplement, and the results are given in the paper.

Mr. ROE: Is it recommended that sowing should be done before or after the rains? After rains it is not possible to get implements on to the land for some time and if extreme dry conditions prevail after these rains the available soil moisture to a depth of 6 in. may be completely removed in 8-10 days. This means that some soil moisture may be lost before the crop can use it. On the other hand, one of the slides demonstrated that a crop sown before the rain was apparently suffering from lack of nitrogen — due presumably to loss by leaching. These two factors operate in opposite directions, one favouring pre-rain sowing and the other not. Which is favoured by Mr. Skerman?

ANS.: The idea is to conserve one summer rain in the fallow and then to sow after sufficient rain has fallen to ensure germination — a 24 hour/day operation.

Dr. DUNLOP: Is anything known of the natural or other regeneration. of Mitchell grass and other species on areas which have been cropped?

ANS.: The usual procedure is for the grazier to reserve an area of about 1,000 acres and divide this into two paddocks of about 500 acres. These two paddocks are alternatively fallowed and cropped.

Mr. WALKER: Is it practical to conserve material above ground?

ANS.: Pits cost about 2/- to 2/6 per yard to excavate. If conservation above ground is practised silos would have to be constructed. In these areas of conservation little indigenous timber and sand for concreting is available.

Reference was made by Mr. Moule of the various techniques proposed to remove the silage from the pits by bull-dozing, using a manure fork lift and possibility of using the silage excavator developed in the U.S.

A major advantage of pits was from the viewpoint of fire risk and rat proofing, plagues of which often occur in these areas.

Mr. WARD: Has there been any co-operation between machinery firms and these silage activities?

ANS.: Yes, excellent co-operation. Difficulty was experienced handling tall crops of sorghum with the forage harvester in that heads of sorghum would be cut off by the cutter bar as it went up the apron.

Mr. BRIGGS: What is the moisture content and protein values for the silage?

ANS. (Dr. Harvey): The moisture content of the silage was 60-70 per cent., which is ideal on published data. The protein content was 6-7 per cent. on a dry matter basis, which may be regarded more as a maintenance than as a productive level. The digestibility of this protein may also be low but this needs further investigation.

Mr. HUDSON: Has there been any experiment using Mitchell grass as silage? If so, what is the quality of such silage?

ANS.: No. But there has been considerable work on the conservation of natural pasture as hay. The yield of hay per acre is low, the fibre content is high and the economics are in favour of silage.