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Producing lucerne hay for North-West pastoral areas.

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PRODUCING LUCERNE HAY FOR NORTH-WEST PASTORAL AREAS

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ON a great number of our North-West and Kimberley stations, surplus water, which could be used for irrigation, is available in large quantities from river and creek pools and bores. Many station managers have made use of these water supplies to very good effect, and others are keenly interested.

The economics of irrigation should be carefully studied before any project is attempted, and the following points may be of some assistance to those intending to develop such an area in the near future.

1. **How much water will actually be available?** The smaller the supply of water, where pumping is necessitated, the greater will be the cost of production per acre. Remember too that when only a small stream is being pumped, i.e., 3,000 gallons per hour or less, a full working day for one man will be required to irrigate one acre of lucerne.

2. **How much "head" must be overcome by the pump?** Consult a good pump table such as put out by the pump manufacturers, and after calculating total "head" to be overcome, determine what type and size of pumping plant would be necessary to deliver adequate water. This is often a limiting factor. If the supply is located in a bore at considerable depth, a vertical spindle pump must be used and this will involve further cost.

3. **How long will the supply last?** River pools can be most deceptive in so far as their capacity is concerned, and accurate assessment of this is almost impossible. However a good approximation is given by the following formula:—

Approx. surface area (sq. ft.) × depth at centre (ft.) × $6\frac{1}{4} \div 4$ = total gallonage.

Evaporation must be allowed for also, for this could be as much as five feet through a hot summer. Bores too can sometimes prove most unreliable when heavily drawn upon over a period of time, and it is important to be sure that the water-bearing layer is extensive before installing expensive equipment. It is advisable to test the supply by pumping, at the rate of flow required, for at least 48 hours.

4. **Is sufficient usable land available adjacent to the supply of water?** If the water must be piped for any distance the project could become uneconomical. If much levelling is necessary, this too can be extremely expensive, and it must be remembered that areas which are severely graded off are rarely very productive. Investigate clearing, levelling, channelling and bay construction costs thoroughly.

VALUE AND PRODUCTION

After studying the foregoing points you will realise that the first acre will be an expensive one, but as the size of the project increases, costs per acre will diminish.

What will an acre of lucerne be worth to you? The number of cuts per year varies (with the growing period) throughout the State, so that some districts will produce more per acre than others. However a safe figure, if soil conditions are satisfactory, is approximately 8 tons of baled hay per acre per year. Ordinary wheaten hay is retailed from Carnarvon at £25 per ton. This cost is increased with transport to the property. The price also increases with the distance north. Lucerne hay, weight for weight, contains

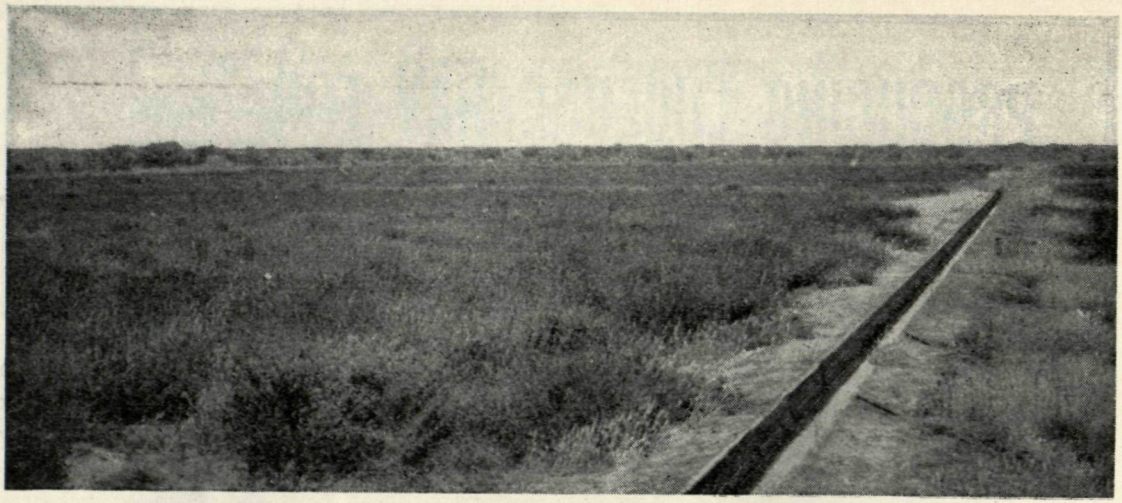


Fig. 1.—A good type of cement channel used for irrigating five acres of lucerne

three or four times the feed value of this, but even when considered at the same price, this would make each station-grown acre worth £200 per annum.

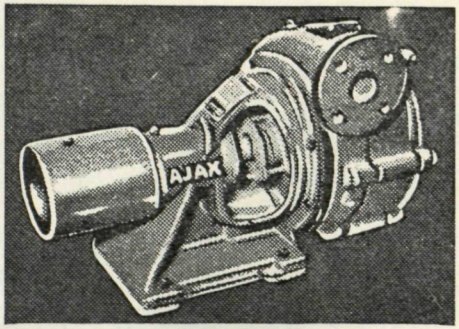
Strangely enough, despite its far greater worth, excellent lucerne hay grown on the Gascoyne is being retailed in Carnarvon at only £27 10s. per ton (and selling slowly), an indication that most local pastoralists are not yet aware of its superior qualities.

PLANTING

The ideal time for planting lucerne varies throughout the north. In the Kimberleys and far North-West, "spring" plantings are rarely successful due to the intense heat which prevails from September until the end of the "wet." During this period lucerne growth is extremely slow as a general rule. The best planting time in those districts is April-May, when the crop has ideal conditions for establishment and weed competition is reduced. In the lower North-West districts satisfactory plantings can also be made in April-May, but at this time of the year considerable weed trouble is often experienced. July, August, September seem to be excellent months for lucerne planting in these more southern districts. Even later plantings are sometimes made but difficulty is usually experienced in establishing a good stand due to the hot easterly winds in early summer.

Where the water supply is nearing the upper limits of salt content (as with some artesian bores) the lucerne is best germinated on the winter rains, since saline water causes a big percentage of seedling mortality. This is best illustrated at "Boodalia," an outstation of "Brickhouse" near Carnarvon. A flowing bore of salt content 140 to 170 grains per gallon is used for irrigation and the lucerne seed was sown in May of 1957. Winter rains were sufficient to germinate the seed and establish the seedlings before any irrigation was necessary. An excellent stand was obtained in this manner, whereas previous attempts to sow and irrigate immediately had been unsuccessful.

The lighter, more friable soil types definitely give better results than heavy clays. On the latter poor germination usually results since the surface crust rapidly sets hard after each irrigation. Seedlings will then often remain spindly for several months, while on the lighter soils quite lush growth can be achieved in the same period of time. It is generally noticeable, however, that once a good stand is developed on clays the growth usually improves, cut by cut, as the roots grow deeper and the surface structure is improved. On the Gascoyne Research Station this has been quite evident in pasture crops. Lucerne which at first would grow no higher than 6 in. before flowering (during the first six months of



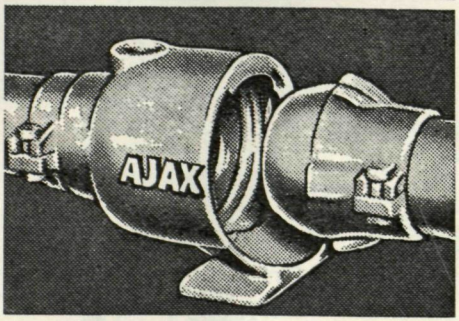


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Fig. 2.—Lucerne being cut for hay by a power mower

growth) now reaches 15 in. or more after 12 months under regular rotational grazing.

When preparing an area for planting, the soil should be broken up to as great a depth as possible by ploughing. The surface should then be brought to a fine tilth—disc harrows seem to be effective for this purpose. The depth of soil at the chosen site should be greater than 2 ft. for best results. The laying out of the bays should be carried out with great care. One must anticipate that they will last for some years, so the more imperfect they are at the outset, the more trouble will be experienced with them as they age. Very careful attention must be paid to levels at all times.

For flood irrigation, bay construction is not extremely difficult; banks can be thrown up with a mouldboard plough and the resulting furrows can then be filled in with a grader or terracer. These banks should not be too large, since haymaking implements may later have to travel over them. It is good policy, in fact, to aim at wide but very flattened banks (or "border checks") so that they may support a large number of plants which can be cut almost as easily as those inside the bay. This

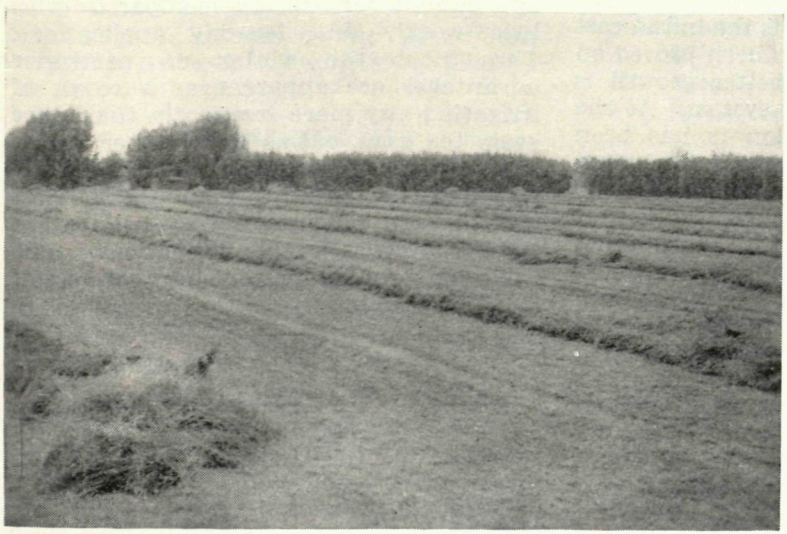


Fig. 3.—Lucerne hay in windrows after side-delivery raking

gives a complete stand over the whole irrigated area.

Bay length should be given careful thought. If the bay is too long, watering will become a problem as the lucerne stools expand. This is particularly the case if the supply of water being pumped is not large. Five chains should be the absolute maximum bay length. Remember that the shorter the bay is constructed, the more efficient the water usage becomes.

As mentioned earlier, when the lucerne stools expand, water flow in the bays will be retarded. For this reason a slight "fall" is necessary in each bay, the optimum being one inch per chain. This "fall" should be even inside each bay—a series of high or low spots will later cause constant trouble. The bays should also be level from one side to the other.

If earth channels are being used for reticulation, it is advisable to instal cement or piping outlets since the soil washed through from earth stops builds up in the top end of the bay, thus creating too much "fall" and reducing the water penetration. Poor growth will result on such built up areas. Cement outlets for systems which discharge a large volume of water should be reinforced with 2 per cent. by volume of steel rod to prevent cracking.

Sprinkler irrigation is practised considerably in the South-West, particularly where the soil is very light. However this method cannot be advocated for northern conditions since, not only is the initial cost vastly increased but it has been proved on the Gascoyne, that far better growth is produced under the flood system. At the Gascoyne Research Station it has been found, with all sprinkled crops (including bananas), that the "raindrop splash" effect accumulates the clay fraction at surface. The resulting thin hard crust rapidly reaches field capacity, reduces penetration to the lower soil layers, and therefore either causes run-off (if the area is not completely level) or increased evaporation, which in turn increases salt concentration at the surface. Pumping also becomes more costly, and in very hot weather watering must be done at night, which is, of course, a disadvantage.

The sowing rate now advocated for North-West conditions is 20 lb. per acre. Broadcasting of the seed is quite rapid and effective (mixing with coarse sand often makes this operation easier) after which light harrows, i.e., diamond harrows, may be dragged over to cover it.

A light manuring is recommended before sowing. This should consist of 2 cwt. of superphosphate per acre, ½ cwt. of potash (as sulphate or muriate) and 1 cwt. sulphate of ammonia. When regular cuttings are being carried out an annual top dressing of ½ cwt. of potash and ½ cwt. of super will be necessary.

Before the seed is sown it should be inoculated with a bacterial culture, which is now obtainable in a black powder or "peat culture" from stock firms and seed merchants. When purchasing this, be sure to specify the fact that it is to be used for lucerne, and give the approximate weight of seed to be treated. If the bacteria perform their function properly, "nodules" will form on the lucerne roots. When carefully cut open and examined these should contain a pinkish bacterial slime, an indication that the colony is active. This symbiotic association between the bacteria and the lucerne will do away with the need for further applications of nitrogenous fertiliser.

IRRIGATION

Some investigations on watering frequencies are being carried out on the Gascoyne Research Station, where weekly applications are being compared with twice-weekly and ten-day applications. Throughout the winter no particular advantages are apparent as a result of irrigating any more frequently than once every ten days, but as the weather warms the figures are proving that once-weekly watering is essential to maintain the best growth. No advantage is yet apparent from the twice-weekly irrigations. The following figures represent tons per acre of dried lucerne hay:—

	Twice Weekly	Weekly	10-days
July	·95	·63	·88
September	1·57	1·82	1·81
October	2·18	2·3	1·87
November	2	1·98	1·4
December	1·75	1·85	1·64

Fig. 4.—A typical "witch's broom" plant (right) compared with a normal stool (left)

Farther north, in the extreme heat of the pre-wet season months it may be necessary to increase to bi-weekly irrigations to gain maximum yields.

For normal irrigations, if the bays are provided with the correct "fall," the flow into each bay may be cut off when the water is still some short distance from the bottom end. This will prevent surplus water from damaging banks or waterlogging the soil. The distance will naturally vary with the length of the bay. It is quite unnecessary to put inches in depth of water onto the crop—one inch will suffice. Theoretically this would require 22,000 gallons of water per acre, but for practical purposes 30,000 would be a closer figure. Thus, if the bays were covered to a two-inch depth 60,000 gallons per acre would be used.

HAYMAKING

Generally, the first lucerne cut is not raked and baled, but is allowed to lie and form a mulch for the young plants. The main value of this first cut is the effect it has on the plant itself, which stools out, produces more tillers and gains vigour. This first cut is carried out when the crop is six to eight inches in height.

Some people find difficulty in deciding at what stage to cut their crop for hay. The rule in warm months is to await the appearance of the first flowers. In cold months (i.e., June, July and August in the lower North-West) the best policy is to watch for new shoots forming at the bases of the stools, since flowering time is usually retarded for weeks by the cold. In Carnarvon, during winter, the time lag between one cut and the next can sometimes be greater than two months.

When a lucerne area is being cut for hay in any of our northern districts, weather conditions must be given careful attention. When temperatures are over 90 degrees the leaves of cut plants dry out very rapidly and are sometimes shed in half a day, thus greatly reducing the value of the hay. The following are some general rules for lucerne hay making:—

(1) Choose a fine, clear day, preferably not too hot.

(2) Commence cutting early, as soon as the dew, if any, has evaporated from the plants.

(3) Cut the crop as close to the ground as possible. Regrowth from stalks is never as good as that from the crown.

(4) As soon as the leaves have wilted after cutting, rake into windrows. This wilting will usually take less than two hours in northern districts—in fact when temperatures are high it is sometimes necessary to commence raking less than an hour after cutting.

(5) Curing takes little time under warm conditions. A simple test

may be performed by taking a handful of stalks and twisting them tightly. If no sap is evident, baling may be commenced. Needless to say, it is unwise to allow the mower and rake to get too far ahead of the baler. If one tractor is being used for the whole operation, and a stationary baler is the only type of baling machinery available, it is best not to cut more than three acres at a time before baling.

(6) Do not leave the bales in the paddock too long—shift them to a shed for stacking. When baling is being done for the first time some of the bales are often too moist, due to errors in judgment, particularly if those employed in the operation have had no haymaking experience. Any "moistness" will be noticed by those tying the wires or strings, and such bales should be stacked separately, then used as soon as possible since they will rapidly go mouldy.

(7) When the haymaking is completed and the bales carted away it is advisable to introduce a large number of sheep for a day or two so that any uncut stools on the headlands or banks are completely eaten down. This reduces pest and disease carry-over.

(8) Irrigate immediately after the short grazing.

PESTS, DISEASES AND WEEDS

Grubs and leafhoppers are the most serious pests encountered in North-West lucerne stands, but are not extremely difficult to control. Spraying with DDT solution, preferably with a boom spray, is very effective if carried out when the shoots are short (up to 6 in.). As already mentioned, the carry-over of such pests can be partly avoided when remaining stools are grazed down after each cutting.

Two main diseases will be noticed in most lucerne areas in the north—they are "little leaf" and rust. The former, commonly known as "bunchy top" and "witch's broom," can do severe damage to the crop if allowed to spread through it. Indeed, in parts of Queensland areas have had to be abandoned two years after planting, due to this disease. "Little leaf" is caused by a virus, which is transmitted from plant to plant on the mouth parts of sucking insects. Unfortunately many native plants in the north are hosts for this virus, so that affected stools may appear in areas which may seem remote from other diseased lucerne stands. It is obvious that if the spread is to be prevented, spraying must be carried out whenever the number of leafhoppers, etc., is seen to be increasing. It is important to spray jassids (leafhoppers) before they reach the flying stage.

Plants suffering from this virus disease put out excessive numbers of tillers which are spindly and very slow growing. The leaflets themselves are less than one quarter the size of those on a normal plant. It is noticeable in cold or very hot weather that many plants so affected fail to recover from a cut. On the other hand, when growth conditions are ideal it is observed that several healthy shoots often emerge from diseased plants. One Carnarvon grower claims that his crop recovered after a heavy application of potash and super. If the disease is obviously causing a drastic fall in production, the whole patch can be destroyed by spraying with 2-4D when new growth is appearing after a cut. The area is then cultivated again and replanted.

Rust is usually most obvious in the cold months when the plants are making slow growth. Damage resulting from it is only slight and it disappears when regular spring cuts are made.

Weeds generally appear in abundance soon after the crop is first planted; however the young lucerne plants usually outgrow these in height if conditions are all favourable. After the first cut, most of these weeds are relatively slow to produce regrowth, whereas the lucerne rapidly tillers out and outgrows most competitors. Further regular cuts favour the crop to the detriment of the weeds.

However some species can compete strongly with lucerne, and if not controlled can even destroy the stand. In the lower North-West districts, couch grass is the worst enemy, and the only effective

control is complete removal of each small patch before it can become established. This often has to be done by hand. "Crab grass," sometimes called summer couch (*Digitaria sanguinalis*), can also become a major pest if allowed to spread, since its habit is very similar to that of couch. In the Kimberley region, weeds become prolific in the wet season. Here, most of the native grasses can outgrow lucerne in the summer months and regular cuts to control them are often not possible since machinery cannot always be transported to the area. However after the "wet," when cutting is resumed and conditions are more favourable to the crop, the lucerne will usually reappear in abundance. Burr grass, or Gallon's Curse (*Cenchrus echinatus*), is another serious weed on lighter soils in the North-West and Kimberleys. The seed of this, if abundant, can often spoil lucerne hay, in addition to the damage done to the plant through competition. Once again the only really effective control is hand weeding when the first few plants appear. It should never be allowed to seed.

USING LUCERNE HAY

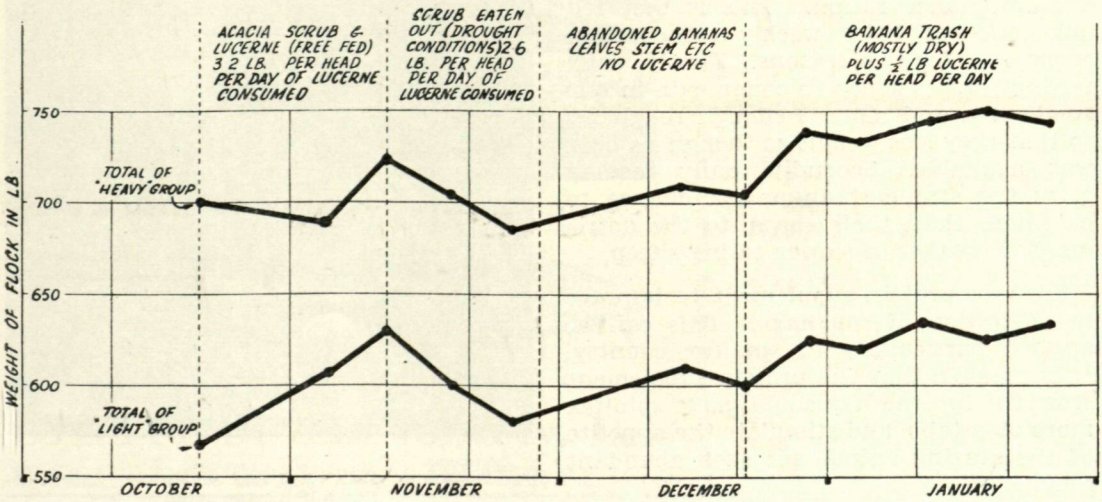
Throughout the north lucerne hay can be used in four ways:—

1. **As a drought supplement for stock.** Little work on the use of lucerne hay as a supplement has been done in this State; however at the Gascoyne Research Station a trial was conducted to investigate the possibilities of feeding it to store wethers for future sale to the butchering trade. Through part of this trial drought feeding conditions were simulated.

Twelve wethers were "free fed" on baled lucerne hay in a small paddock containing wattle scrub. As shown in the graph, their weights increased until the scrub was eaten out completely, when they began to fall away. Not only did the sheeps' body weights decline, but their appetites for the lucerne hay decreased. Whereas 3.2 lb. of lucerne per head was being eaten daily when the scrub was available, this fell to 2.6 lb. per head under true drought conditions. Later, the flock was moved onto an abandoned banana patch where, while green material was available, the weights increased without any supplement. When only coarse and dry roughage remained, a lucerne ration of ½ lb. per head per day, was fed and once again, body weights increased steadily. (See graph).

In a trial carried out in New South Wales, sheep were fed lucerne hay only over a period of time. They consumed a relatively low quantity per day—2½ lb. per head. Instead of being able to utilise the protein from the lucerne, the sheep were actually in negative nitrogen balance—that is, more nitrogen was being excreted than was being eaten (as protein) in the

GRAPH SHOWING TREND IN SHEEP WEIGHTS IN FEEDING TRIALS, GASCOYNE RESEARCH STATION



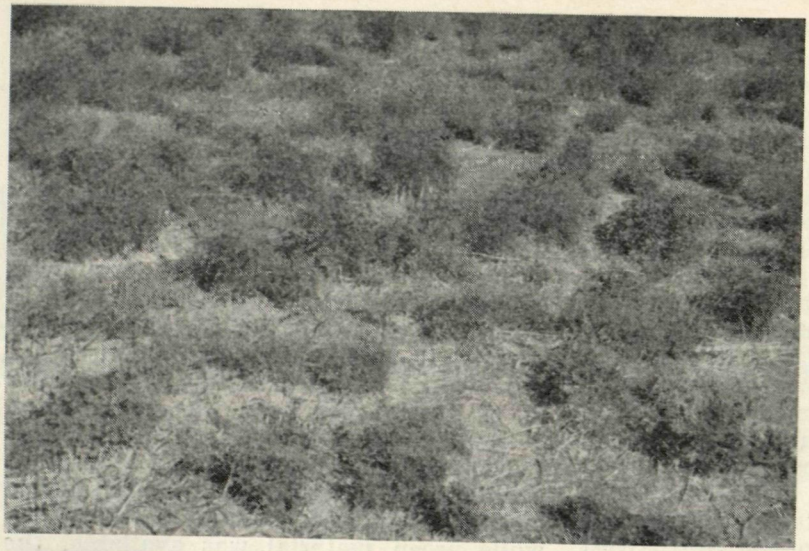


Fig. 5.—A three-year-old stand of lucerne badly affected by "little leaf," or "witch's broom"

lucerne. Apparently the all-important ruminal bacteria became geared to dealing with the high nitrogen diet and rapidly deaminated the lucerne protein, forming ammonia, which was absorbed by the blood then excreted via the kidneys as urine. The animals then had to draw on their body nitrogen reserves for their metabolic processes, the waste nitrogen products of which were also excreted.

Bulk of some kind, even if of poor quality, would therefore be necessary in addition to any such high protein product as lucerne hay, otherwise most of the nitrogen will be wasted. Where such bulk is available, about 10 oz. of lucerne hay per sheep per day should be sufficient for a maintenance ration. This is best fed only once or twice weekly rather than every day, for two reasons. Firstly, daily feeding causes sheep to congregate in one small area and not eat enough roughage, so that they lose weight as though no bulk was available. Secondly, daily feeding gives the strongest animals a chance to eat more than their share, to the detriment of weaker or slower eating sheep.

2. **As a protein supplement to improve the digestion of roughage.** This can be applied particularly to spinifex country. It is possible that the protein supplement from the lucerne hay could make spinifex more digestable and stimulate the appetite of the grazing animal for such abundant roughage.

Work carried out in South Africa at the Dohne Research Station has proved the value of a lucerne hay supplement in assisting sheep to utilise completely dry grass pasture. Here the nutritive value of the native pasture is at its best in spring or early summer, but it falls to a minimum in winter months. When given one pound of lucerne hay per head per day as a supplement (fed twice weekly) the test animals actually made small weight gains over the period, whereas those on the dry veldt only, lost over 20lb. per head.

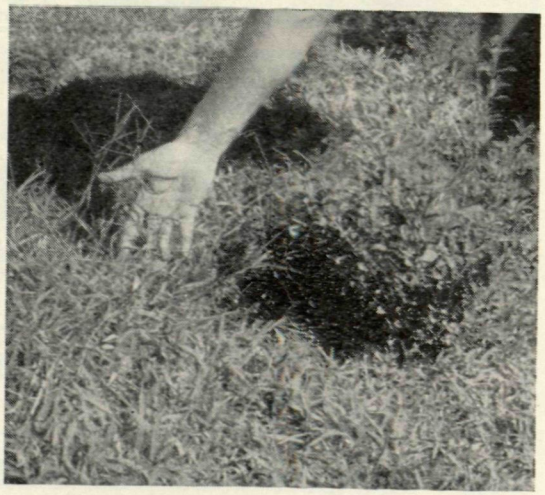


Fig. 6.—Crabb grass *(Digitaria sanguinalis)* has overrun this lucerne stand

3. **As a protein supplement to increase lambing percentages,** is another possible use which is being investigated at Abydos with four objects in view. Firstly, it may be possible that a protein supplement such as lucerne hay could bring ewes into season for planned matings which would give a lamb drop when the pastures are at their best. This may also increase conception rate. Secondly, a further protein supplement fed to the ewes in the last few weeks of pregnancy, could save many lambs which would normally be lost due to the low plane of nutrition. Thirdly, many more lambs could probably be saved if a lucerne supplement was fed for some time after lambing, thus maintaining the milk flow in the ewe. Rams, also, could perhaps be "flushed" with a protein supplement just prior to mating.

4. **As a protein supplement for working horses.** To date this has been the most common usage of lucerne hay on North-West stations, and in this respect it has proved extremely valuable in helping working horses to utilise the dry grass which is usually the only feed available at mustering time.

On the whole it can be seen that there is scope for considerable research on supplementary feeding in the North, but the indications are that lucerne hay would be a great asset to any station.

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