being obtained, while with moderate rainfalls wheat would yield 3} bushels for each meh of rain received during the growing period of the crop, Victorian wheat growers as a whole had obtained during the last few years only 1.1 bushels for each inch of winter rain, and the South Australian wheatgrowers 0.95 bushels per inch of winter rain. On the other hand, the whole of the wheatgrowers of the Wimmera had averaged during the last five years 1.75 bushels of wheat per inch of rain, while in the Longerenong College Farm and the competitors in the Wimmera Farm competitions, an average yield of 31 bushels had actually been obtained for each inch of winter rain received. The Longerenong College Farm had actually obtained a yield of 49 bushels per acre over a 350 acre area during the past season. Requirements Fluctuate.

not constant, but fluctuated from season to sesson. High water requirements were associated with low rainfall, high temperature, strong winds, low atmospheric humidity and intense evaporation during October and November. In Victoria over 60 per cent, of the water required by a crop was used up in October and November, though the growing period extended over seven months. A consistent relationship was found to exist between the transpiration ratio and the evaporation from a free water surface. In many parts of the wheat beit the evaporation rate was

from dry, northerly winds during October. Those winds, usually more frequent in dry seasons, greatly accelerated transpiration, nd resulted in lowered crop yields. Regions of low annual rainfall were usually regions of high evaporation. In such localities the water requirements of crops had to necessarily be high so that crops were likely to suffer from the double disadvantage of shortage of rainfall, high transpiration rate, and knowledge of the rate of evaporation from a free water surface was thus as important as a knowledge of rainfall in determining the suitability of arid lands for settlement. Many of the factors influencing the economy of water used by plants which had been commonly regarded as directly influencing the tranparation rate as such were rather factors a plant nutrition. Any factors which assed malnutrition resulted in a relatively. th water requirement within production dry matter because of the continued use a water without a normal increase in dry matter. Transpiration appeared to be a purely physical phenomenon depending

primarily on the evaporating power of thecosphere, but it could be modified to considerable degree by the variety of crop, fertility of the soil, application of soluble phosphates, and controlling the Her supply.

Differing Requirements. The varieties of wheat tested showed a for grain. That was of great practical significance in the breeding of wheat varieties for arid districts. The proportion of grain to straw was a factor of importance in the creation of wheats for arid districts, for that determined whether the variety would utilize the scanty water supplies economically in the production of grain. The application of soluble phosphates found to produce a marked lowering in the water requirement of wheat. The effect the transpiration ratio. Any factors which aided the more perfect development of a wheat crop-well tilled soil, use of appropriate fertilizers, supply of conserved soil moisture, and seeding of the crop under favourable conditions, enabled wheat to produce grain at a minimum water cost. The production of new wheat varieties to meet the requirements of a low transpiration rate opened up a field of vast possibilities. Earliness or maturity and high migration ratio were of great importance in the production of wheats for arid localities. With evolution of hardier strains with low water requirements new territories might be subjugated

and the utilization of existing areas be made more effective. transpiration ratio for wheat was lowest ripening stage. During the final stages the transpiration ratio was three to four times as high as that of the earlier stages. That emphasized the need of early maturing varieties in hot dry areas of the wheat belt, where the ripening period was excessively rapid. Recent investigations in Victoria showed that the mineral nutrients were taken in rapidly in the early and had used up only 18 per cent, of their total water supply. Those results empha-sized the necessity of having an abundance. of soluble food constituents in the soil at seeding time, either by the application of fertilizers or by the thorough preparastudy of the water requirements of crops and the relationship between rainfall and wheat yield, confirmed by the results abtained by the best wheatgrowers in the Wimmera, enabled him to affirm, with some degree of confidence, that the average yield of the wheat belt of Victoria could be at least doubled before the limits imposed by the rainfall were approached.

## Register PEA GROWING IN WHEAT AREAS.

#### Possibilities of Future.

Mr. W. S. Kelly (Chairman of the South

Australian Advisory Board of Agricul-

ture), lecturing to the agricultural section, dilated on the possibilities in this State! in connection with the wheat areas. Mr. Kelly, referring to the need for rotation trop. seeking after a system that would neep to maintain the fertility of their soils and add to the stock-carrying capacity of their farms. Many systems were being tried, and some, with the aid of clover or lucerne, were very suitable for rough or Advantage of Moisture Conser-The water requirements of wheat were distant country. Small farms of good agricultural land, however, had to be farmed under a rotation that vould make it possible to grow wheat frequently. Peas could, in a 20-inch rainfall, be rotated with wheat so that wheat could be grown tion with wheatgrowing formed the subevery second, third, or fourth year in ject of an address by Professor J. W. accordance with what rotation was adop- Paterson, of Perth University to the ted. Referreing to the value of the crop, agricultural section. In the course of his he said that it was difficult to be certain address Dr. Paterson made a strong plea as to yields; but it seemed reasonable to for greater discernment in interpreting assume that the yields would equal in the benefits of fallowing. Thanks to the bushels the yield of their wheat crops, active propaganda work of departmental bushels per acre. He asked them to sup effective efforts of the agricultural press, pose that 100 acres were grown on a farm the general advantages of fallowing were subject to great temporary acceleration of oats. With the help of the peas pro- ample, he said that in 1923 the Western hably 400 breeding ewes could be kept Australian wheat belt had too much rain on the farm mentioned, and at the same early in the growing season, and yet time the other crops need not suffer. the crops on fallow always appeared There were many essential conditions in stronger and healthier than those the proposals he had made. Peas seemed on dry-ploughed land. It was not conto require at least an 18-inch rainfall. The ended that moisture conservation was unsoil should be good and friable. Heavy important. It was frequently most imfrosts were a danger. The land should be portant, but it was not everything. Falfallowed after harvest, worked down with lowing conferred other benefits, any or the first rain, cultivated just prior to seed all of which might contribute strongly to ing. The peas should be sown by the end the increased yields. On the heavier soils of June, as it was better to chance the especially it would, by the action of time frosts than the hot winds. It was essen- and judicious cultivation, lead to flocculatial to kill the weeds, not only for the pea tion of the finer clay particles, giving a crop, but also for the subsequent wheat better soil aeration, and a good tilth. crop. The harvesting of the crop under Again, by spreading the work of the farm present-day conditions was simple, because it gave more time to plough properly and of the machinery, which would handle peas without scamping-a special advantage on as well as wheat. One man could now the heavier soils. Further, it helped effireap from 50 to 100 bags per day. It was ciently to kill weeds-a feature of special wide variation in the transpiration ratio wiser to harvest much of the crop, as to import in the older districts. Finally, feed large areas to sheep was risky and it assisted powerfully in providing within wasteful, except where they had very large the soil a supply of nitrates ready for the numbers of sheep on hand. When in the next crop. Nitrate supply might frebag the peas could be kept until required. quently be the principal cause of improved There were many who would contest the yields from fallow. Along with Mr. P. point of the success of the subsequent R. Scott, of the Victorian department, he wheat crop. That was determined largely had in 1912 ascertained that a good falby the moisture available. Peas would rob the soil of some moisture, and therefore it. was essential that the rainfall should be adequate. On their best agricultural areas of a suitable fertilizer in aiding the plant large quantities of peas could be grown. to economise water supplies was an im- That would greatly increase the stockportant factor in relation to the control of carrying capacity of their farms. At the same time their wheat yields need not

## OATS AND SHEEP.

suffer.

By Mr. J. T. Pridham.

To the agricultural section, Mr. J. T. Pridham, Government Plant Breeder of New South Wales, lectured on oats and

He stated that, in view of the fact that relatively high prices for sheep and wool Tests made in Victoria showed that the were likely to continue, it was advisable to give primary consideration, on a holdduring the early stages, and progressively ing devoted to sheep and wheat, to the increased as the wheat approached the stock rather than the wheat. For that purpose equal areas of oats and wheat might be sown and the oats used as fodder; the crop to be sown from March to May, grazed off, and made into hay and stiage. The sheep would be mainly kept on the green crops, silage, and good oaten chaff. Border Leicester merino ewes mated with Romney Ryeland or Dorset stages, and the bulk of the water used rams were recommended for an autumn in the final stages of the growth of the lambing. The drop of lambs would be crop. Thus it was found that the middle fattened and sold in the summer. Eves of September wheat crops had taken in of that class cut a good fleece, and the over 60 per cent. of their mineral re lambs fattened quickly. Algerian oats quirements, though they had formed only were not early enough to give best results, 27 per cent. of their total dry matter, though they gave a very heavy crop if the farmer could afford to wait for them. Sunrise, Mulga, Scotch Grey, and Lachlan oats were suitable for early fodder, and fitable to grow in respect to quality as well where trefoil or clover was not plentiful it was best to sow a mixture of oats and an early variety of field peas, Growers were advised to pay attention to the selection of seed as well as to obtaining a good line of ewes and well-bred rams. The rofation would be:-First year, wheat; second, fallow; third, oats; fourth, fallow. All crop was thus grown on fallowed land. The experience of the Department of Agriculture was that the Sunrise oat was about the best fodder for the purpose, On the average it yielded better than wheat or barley, and stood feeding off well. Austra'ia produced more wheat than

oats, but in Canada the reverse held good.

reservings Canada grew so-much outs ber more than double the amount in last export of wheat was much greater. The season's oaten hay. In common with bulk of her oats went to feed live stock other sorghums, sudan grass was pointin the winter. To get the best results nous when young, but only about one from a limited area they had to hand feed third as bad as common sorghum. Anaor graze cultivation paddocks, or do both lyses of the plant towards maturity The time had come when it did not pay showed the formation of hydrocyanic acid to rely on natural pastures alone. There to be negligible. Berseem clover, introwas no valid reason why good wool as well duced by Professor Perkins from Egypt, as fat lambs should not be raised on a provided 30 tons of green feed per acre farm, and, with the improved oats they per season. It was comparatively high now had, a larger number could be carried in proteins, and a useful legume when, than was possible under the old methods during the winter, others, such as lucerne, of "wheat and sheep" and with better were at a standstill. Tables comparing the

## WHEAT AND FALLOWING.

# vation.

The value of correct fallowing in connec-Thus they would be able to reap 15 to 30 lecturers and writers, and the equally of a square mile, 500 acres of which were now widely appreciated. It was becoming arable, and then to assume that 20 acres apparent, however, that much of that prowere fed direct to sheep. That would paganda work was too general in its leave 80 acres to be reaped. If that area treatment of the subject, in that it simply averaged seven bags per acre, 560 bags recorded instances of the increased yields would be harvested. If 60 were reserved from fallowing, elaborated at considerable for seed, 500 bags would remain, and if length a description of cultural methods that quantity were fed to the hoof it and their season of application, and was of the farm. Peas were very high in albu- up to the increased yields. Where reasons minoids, their content being nearly 20 per came into question it was more or less cent. of that essential property. Consider tacitly assumed that the improvement was

> low at Geelong was able to prepare 148 Ib. of nitrate nitrogen per acre, as compared to 32 lb. on land which had been under crop the previous season. That difference of nitrates in favour of fallow would become still greater in districts enjoying no-or only sparse-summer rains. Where crop had to be seeded on dryploughed land, and especially under good | soil. The clay was very stiff, and its surwinter rainfalls, 20 to 30 lb. of sulphate | face was very irregular, compared with of ammonia might be added to the super- that of the soil surface-hence the poor phosphate dressing.

> the gross benefit of fallowing was a com- was alkaline. Continuous cultivation posite result of various soil improvements effected by cultivation and rest. In no case would the improved yield be due solely to moisture conservation, improvement of soil texture, killing weeds, or to nitrate production, but the relative importance of those functions would vary with each particular district and season. Insistence on the general benefits of fallowing without specific reference to the reasons was unscientific. It conveyed no intelligent information to the farmer, and might even deter him from seeding unfallowed land for no better reason than that he had been advised against it.

#### OATS AS FODDER.

#### Value of South Australian Fodders.

"Little attention has been given to the feeding value of fodders in Australia," Mr. A. T. Jefferis (State Agricultural Chemist) and Mr. C. S. Piper told members of the agricultural section. They added that at Roseworthy College in the last two years considerable work had been done in order to gain knowledge of crops proas yield. Mr. Colebatch (principal of the college) introduced some 13 varieties of oats in order to discover one which would provide green feed in winter as well as hay and grain. It was pointed out that, owing to the great seasonal variation, a comparative valuation of the varieties could only be obtained after many years' work. An examination of the average analysis for all varieties in each season was, however, very instructive, at the percentages of proteins at all stages were much less in 1923 than in 1922, particularly in the hay, which fell from 6.9 to 3.6 per cent. Sudan grass was seen to contain over 10 per cent. proteins when in flower

composition of shrivelled grains of wheat, oats, and barley with plump grains, showed the former to be higher in proteins and fats, and, therefore, providing the digestibility of screenings compared favourably with the plump farmers were making grain. a mistake at selling them at a low price and retaining good grain for feed. Importance of Proteins.

Referring to food values in general as

applicable to Australian conditions insufficient stress was laid on the importance of proteins. Early systems were based almost entirely on protein values. The present starch equivalent basis valued proteins at less than either fats or carbohydrates. However that might apply to a completely stall fattened animal, it was entirely misleading with regard to young stock, breeding and wet ewes, and heavily worked horses, under South Australian conditions, where a large portion of food was gathered from pasture and stubble, high in starch and fibre but poor in proteins. The farmers in the Gawler district had been complaining that last season's hay would not keep their horses in condition, whereas that of 1922 was excellent. As had been already remarked the proteins were only one-half as high would greatly add to the carrying capacity too little analytical of the reasons leading in the 1923 hay, giving a nutritive ratio of 1 to 22, against 1 to 11. On the starch equivalent basis last season's hay was somewhat higher in value, whereas in ing its weight and its richness a bag of due to moisture conservation. That was actual practice it was greatly inferior, peas was worth nearly as much as 3 bags by no means always correct. As an exlack of proteins in that hay, owing to the exceptionally wet season, had caused the inferiority, and no amount of crushed oats of the same harvest could bring the ration to the required nutritive value. In the compounding of rations and balancing of pasture, fodders with high protein contents, such as lucerne hay (nutritive ratio 1 to 3.3) bran (1 to 3.6), peas (1 to 3.2). or even concentrates, such as linseed meal (1 to 1.4) might be found necessary, Handfeeding of stock was in the ascendancy throughout Australia, particularly during the colder months, when natural pasture was scarce, and as their pastoral industry was computed to be worth some C70,000,000 per annum, there was scope for very valuable work in the laboratory and feeding pen.

## SOUTH-EASTERN SOILS.

#### Their Possible Correction.

The manner in which a possible correction of certain soils of the south-east of South Australia could be made, formed the subject of a lecture to the agricultural section by Professor L. J. Cook.

Professor Cook said that in that district

a large proportion of the Kybybolite soils were cementy ironstone loams, of approximately 1 ft. depth, over yellow clay subunder drainage. The soil in its virgin In conclusion, the professor claimed that | state gave acid reaction, but the subsoil without manuring tended to increase acidity, and continuous cultivation with applications of superphosphate, or crushed rock phosphate, tended to increase acidity. Good bare fallow, variously fertilized with phosphates, showed acid reaction, while improved pastures by use of phosphatic fertilizers only, showed no improvement from acidity, and the soil, dressed with 1 ton of lime per acre, whether on pasture, or cultivation land, gave an alkaline reaction. The country had an average rainfall of 22.61 in., with comparatively heavy winter rains. The soil saturated quickly, and quickly dried out hard, hence the period in which soil was in good cultural condition was often very short. One ton agricultural lime per acre would maintain the soil sweet for at least five years. Smaller applications gave much slower results. Crops, grasses, clovers, &c., on limed areas started their growth earlier, grew quicker, and were less affected by saturation, and recovered from wet periods quicker than on unlimed areas. Liming had increased the organic content of the soil. Subterranean clover was one exception to that rule. It was establishing itself consistently well in the sour soils without the aid of lime, and was increasing the stock-carrying capacity of the fields more than threefold, by an outlay of from 20/ to 25/ per acre for seed and phosphatic fertilizers.

## TRAINING AGRICULTURISTS.

## Education Association Suggested.

In a paper prepared by Mr. W. J. Colebatch (director of the Roseworthy Agricultural College) and Mr. R. C. Scott, and read to the agricultural and forestry section, the writers stated that they had, in the Commonwealth, an ever increasing