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COMPETITION BETWEEN WHEAT AND UNDERSOWN PASTURE  
WITH PARTICULAR REFERENCE TO THE LIGHT FACTOR.

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1.0.0. INTRODUCTION

The practice of establishing pasture under a cereal or other crop has gone on in many countries for a long time. The main purpose has been to obtain some return from the field in the year of seeding, since grazing in that year may adversely affect establishment. Apart from this economic factor it is also claimed that the cereal crop "nurses" the pasture seedlings in winter.

The cereal crop sown with the pasture is variously called "cover crop", "nurse crop" or "companion crop". The first term is also used where crops are sown to provide a cover to the soil to reduce the risk of erosion. The second term implies that the cereal crop nurses the pasture, which in fact, occurs only rarely; more often the growth of the pasture is harmed. These two terms are of wide use in the United Kingdom. The third is used mainly in the United States of America. In this thesis the practice will be referred to as "cover cropping" or "undersowing" and the cereal crop as the "cover crop".

The cover crops most commonly used are small grain

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cereals such as wheat, barley, oats and rye. Corn (maize) and some legumes and flax are also used in some parts of the world. The cover crop is usually harvested for grain, but may be grazed at an early stage in the growth cycle or cut for hay or silage. Removing the cover crop at an early stage is advocated particularly in dry areas in order to eliminate competition and thus improve the establishment of the pasture. Cover cropping is also practiced to provide winter feed for stock in areas where winter growth of pasture is low.

Particularly in dry years, undersown pastures often fail to establish satisfactorily. As a result the practice of undersowing has been abandoned in favour of pure cropping in many places, while in others attempts are being made to understand the processes involved, and to devise methods whereby satisfactory growth and yield of both crops can be obtained.

The phenomenon involved is one of competition between the cover crop and the pasture for those factors of the environment essential for growth, such as soil moisture, nutrients and light. Competition arises when in an association the demand of all plants present for one or more of the above factors exceeds the supply; when this occurs those plants best able to obtain a supply of the factor in short supply will flourish, while the others will become subordinate (suppressed). The extent of dominance of one species and the suppression of another depends

on the difference between them at the initial stages of growth (embryo and seed size), the relative growth rates and the height and spread of shoot and root systems. Cereals in general have larger seeds, higher growth rates and taller shoot and deeper root systems than pasture species, and are therefore better able to exploit soil reserves. Even when the soil factors are in sufficient supply the cover crops, due to their greater stature, would shade the pasture, the growth of which would be reduced. Thus it would appear that there is always likely to be some reduction in growth of pasture when undersown.

Experience of sowing pasture seeds into already established cover crops has shown the practice to be generally unsatisfactory, due to greater competition from the cover crop. It is also well known that reducing the rate of sowing and/or increasing the row width of the cover crop improves the establishment of the pasture. In most instances the cover and pasture crops are sown together along the same row and experiments have shown that separating the two crops in alternate rows or sowing them at right angles to one another result in better establishment of the pasture. Recent work in U.S.A. has demonstrated that sowing in alternate rows running North-South result in better growth of both crops than where rows are sown East-West.

With a few exceptions these studies were concerned

mainly with either the effect of the cover crop on pasture establishment or that of the pasture on the yield of the cover crop or both, with a view to making practical recommendations. Very little attention has been given to an analysis of the growth factors involved and the extent of competition for them.

In Australia the importance of the pasture phase in a rotation cannot be overemphasized, yet the best way of establishing the pasture has not been fully worked out. In South Australia, with a Mediterranean type of climate, wheat and other small grain cereals are widely cultivated. In the early part of this century farms were cropped to cereals continuously and as a result the yields dropped to very low levels. Following the introduction of wheat - fallow - wheat rotation there was some upward trend in yields; and inclusion of a few years of pasture in the rotation brought about a 50% increase over that obtained by continuous cropping to cereals. This increased yield is claimed to be due to high levels of nitrate nitrogen fixed in the soil by the clover and other legumes in the pasture. Furthermore a very high percentage of the sheep population of the state is maintained in the cereal belt. Thus a highly productive pasture in this area would have a two-fold advantage, and a marked swing to the use of a pasture phase in the rotation has been noted. A typical practice is to seed 2 lbs. subterranean clover (Trifolium subterraneum L.) and 1 lb. of annual rye grass

(Lolium rigidum Gaud.) with the last crop of cereal in the rotation, but in some places only the clover is sown as the amount of volunteer rye grass and other grasses is considered sufficient for a satisfactory sward. Some annual medics (Medicago spp.) are used in some parts instead of the clover.

In this thesis, after reviewing available literature on the subject and assessing the effect of cover cropping under Adelaide conditions, an attempt is made to determine the nature and extent of competition for the various factors, particularly light, by studying the microclimate and the growth of clover beneath wheat crops sown in various ways. While studying the effect of the cover crop on the pasture, the effect of the pasture on the cover crop was also taken into consideration.