Pasture establishment on old cropping country in southern Queensland

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Abstract

Large areas of marginal cropping lands are being sown to permanent pasture after 30–50 and more years of cropping. Organic matter and overall fertility of these areas have been depleted and soil structural issues are common. Annual grass and broadleaf weeds are present in many of these old cultivations. However, the period of seed-bed preparation and sowing is the time where a land manager has the greatest opportunity to influence the conditions that will enhance the prospects of a successful establishment.

Pasture establishment is a ‘numbers game’, based on the germination, seedling emergence and survival of the number of seeds that are sown per unit area. The effects of seed quality and dormancy, soil moisture and sowing depth on germination and establishment are discussed. Best establishment is likely to be achieved by sowing the seed into a dry soil surface that has adequate stored moisture within 5–7 cm of the surface, rather than broadcasting it on the soil surface. On the other hand, optimum sowing depths for most small-seeded pasture species are often only 10–20 mm and sowing too deep will reduce emergence. Seedling growth and survival are dependent on moisture and fertility, but this can be heavily influenced by competition from aggressive annual weeds. Suggestions for applying the principles and achieving the best possible establishment outcomes under field conditions are discussed.

Introduction

In its simplest form, pasture establishment might be considered as the sowing of seed with the objective of achieving a certain population of plants that will reach maximum productivity in as short a period as possible. The quicker the pasture reaches full production, the more economic it will be for the landholder, and vice versa (MacLeod et al. 1993). Where protection of the soil from erosion is also an objective, quick establishment and the rapid development of ground cover are vitally important.

Large areas of marginal cropping lands are now being sown to permanent pasture after 30–50 and more years of cropping. Such areas include the sloping uplands in the better rainfall areas within 200 km of the coast, as well as the large areas of undulating and plains country in the lower rainfall areas further inland. The subcoastal uplands, which initially started with soils of moderate-high fertility, have been sown to forage crops for decades using conventional farming practices. As a result, there has been serious loss of soil through erosion, as well as a general decline in soil fertility. Further inland, where rainfall is more marginal for cropping, many of the loamy soils, that were initially of low-moderate fertility, possessed a fragile structure that depended heavily on organic matter for water infiltration and good soil tilth in seed-beds. With the soil organic matter now largely depleted, these soils are often hard-setting and scalds are common. As a result, there is high run-off during storms and it is difficult to develop the profile of moisture required for crop performance. Many of these soils were always marginal for cropping but provided economic returns during the early years when few inputs were required. Poor returns from livestock enterprises during the 1970s and 1980s also contributed to the decision to crop these areas. The decline in organic matter and associated soil structural deterioration now mean that these soils are no longer economic to crop, despite the development of
better farming practices. Such characteristics also pose challenges for the establishment and development of productive pastures.

High radiation and high temperatures during summer in northern Australia, together with variable and erratic rainfall, make pasture establishment a risky procedure in many areas. A high proportion of the rain falls as high intensity thunderstorms during summer, and is commonly associated with hot, sunny conditions that lead to rapid drying of the soil surface following rain (Miller and Perry 1968; McKeon and Brook 1983; Cook 1984). Most favourable conditions for establishment occur when rain depressions bring 3 or more consecutive days of rain and overcast conditions.

During seed-bed preparation and sowing, a land manager has the greatest opportunity to influence the conditions that will enhance the prospects of a successful establishment. Conditions for germination, emergence and early growth can be influenced by the cultural and husbandry practices that are employed during seed-bed preparation and sowing. Seedlings establishing in later seasons are at the mercy of environmental and biotic conditions and often little can be done to manipulate these in order to favour plant establishment. Therefore, stands that start with low populations often take many years to thicken up and the chance of establishment failure is greatly increased.

Many factors can affect pasture establishment, including both the external physical and biotic environmental factors, as well as management (Gramshaw et al. 1993). These factors are closely interlinked with most management decisions aimed at modifying the environmental and soil factors to favour the germination and establishment of the seed being sown. This paper discusses the various factors affecting pasture establishment within the context of ‘pastures for protection and production’, which is the theme of this conference. The principles of establishment apply equally to both grasses and legumes, although more time is given to grass establishment in this paper, because grasses are seen as the core species around which protection and production are based. In order to understand how the various factors and management decisions can affect establishment, it is best to break pasture establishment into 3 phases, seed germination, seedling emergence and seedling growth and survival.

Seed germination phase

Effects of seed characteristics and dormancy on germination

The ability of a seed to germinate depends on whether it is alive, fully mature and free of dormancy factors. During seed production, new seed heads of tropical grasses emerge progressively, often over a period of 2–6 weeks. Studies with Gatton panic have shown that individual seed heads may take up to 3 weeks to complete flowering and seed maturation, with the mature seeds being shed about 6 days later (Hopkinson and English 1982). Therefore, at any point in time, there will be a proportion of mature seed, immature seed and florets that are still to flower. Peak ripeness with presentation yields near the maximum may last only a few days, or perhaps 1–2 weeks, making the timing of harvest critical, in terms of maximising both seed yield and quality (Loch and de Souza 1999). In addition, the conditions under which the seed is stored between harvest and sowing are likely to further modify seed quality (Hopkinson and English 2005). Such characteristics of tropical grass seed production and storage also have implications for the quality of the seed being sown.

Both grasses and legumes can exhibit seed dormancy. In legumes, dormancy generally takes the form of hard-seededness, whereby the tough outer coat of the seed mechanically inhibits or excludes the uptake of water and/or gases, thereby preventing germination. This hard-seededness is often broken down during the harvesting and threshing process. Seed that remains hard following processing may need to be scarified in order to improve germination prior to sowing (Argel and Paton 1999).

Dormancy in grass seed is generally caused by chemical inhibitors that are present in the embryo, with its influence being strongest in fresh seed and decreasing with age of the seed (Harty et al. 1983; Hopkinson and English 2005). Grass seed dormancy often interacts with moisture conditions in the field to influence germination and establishment. However, this interaction is often complicated and not well understood. For example, Hopkinson (1993) reviewed the results of a series of experiments which showed that good quality green panic (Panicum maximum var. trichoglume) seed that was less than 12 months old established poorly in 3 plantings that experienced...
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intermittent rainfall, but established quite well and was consistent with test quality in a fourth planting that experienced continuously available moisture over the critical period. Partially dormant seeds are also slower to germinate and so are likely to be exposed to hazards in the field for longer than non-dormant seeds, thereby resulting in greater losses during germination. This, together with the recent work of Hopkinson and English (2005), suggests that establishment of grass seed less than 12 months old is likely to be less reliable than that of older seed, irrespective of the quality determined by laboratory methods and reported on seed certificates. However, it may be possible to improve the germination of dormant grass seed by coating the seed with materials containing dormancy-breaking chemicals (Song and Kalms 2007).

Effects of seed placement on water uptake and germination

In most subtropical and tropical areas, the dominant factor affecting field germination is soil moisture. Soil moisture conditions vary widely, from dry to intermittently wet and dry, such as might be experienced in stormy weather, to extended wet periods lasting 4–6 days and more. To germinate, a seed must imbibe water from its surrounding micro-environment. The rate of imbibition depends on the soil water content and the degree of contact between the seed and the moist soil. Seed placed on the soil surface can imbibe water only through the area of seed coat that is in contact with moist soil (Sedgley 1963) and the exposed seed surface also loses water to the surrounding micro-environment. Most studies relating soil moisture to germination have been carried out with surface-sown seed in the absence of soil disturbance or cultivation. Broadcasting seed onto the surface of a freshly cultivated soil will generally improve soil-seed contact, water imbibition by the seed and hence germination. If the seed becomes buried in the loose soil through raindrop action, imbibition of water by the seed is likely to increase even further and evaporative losses from the surface of the seed are likely to decrease, resulting in even better conditions for germination (Cook and Dolby 1981). However, once the rain stops and the clouds clear, high radiation and high temperatures often dry the surface layers of the soil rapidly to wilting point, often in less than 24 hours (Miller and Perry 1968; Winkworth 1969; Cornish 1983; McKeon and Brook 1983). Under such conditions, the prevailing weather conditions (Winkworth 1969; Cook 1984) and micro-environment surrounding the seed (Miller and Perry 1968; McWilliam and Dowling 1970; Cook 1984) can have a major impact on germination. The presence of surface cover can slow moisture loss and reduce the rate of drying of the soil surface (Rickert 1973; Mott et al. 1976; McIvor and Gardener 1985), especially where hot sunny conditions follow rain. Where old cultivations are being sown to pastures, the retention of stubble and zero or minimum tillage technology for pasture establishment are therefore likely to be worthwhile objectives.

Sowing pasture seed so that it is covered with soil will provide the best conditions for germination. The deeper the seed is sown the longer the soil surrounding the seed will remain moist following rain. Compressing soil around the seed by rolling, or use of press wheels, further improves germination (Choudhary and Baker 1980; Ward et al. 1991), the advantages being most evident in sandy or loamy soils where moisture for germination is limited.

Under fluctuating wet and dry conditions, it is possible for grass seed to imbibe water and start the germination process, then dry back without loss of germinability, provided that it has not reached the stage of radicle emergence. This process, termed hydropeidesis, was first described by Watt (1978), working with the native Queensland bluegrass (Dichanthium sericeum). Watt (1982) recorded similar observations for a range of other tropical grasses and Hopkinson (1993) suggests that the process is indeed widespread among tropical grasses. When the seed is wet up again, the time taken to germinate is shorter than if the seed had not previously been wet, suggesting a form of priming and potentially conferring an establishment advantage. However, long dry periods can lead to the loss of seed through deterioration. Actual losses are difficult to quantify but are likely to depend on seed temperatures and moisture contents, with the extent of deterioration increasing as the interval between sowing and rainfall lengthens (Hopkinson and English 2005). Seed that is covered by soil would also be expected to gain some protection and have a longer life expectancy than seed exposed on the surface of the soil.
Seed coating. Seed coating or pelleting, as it is often known, has been shown to increase the uptake of water by surface-sown seeds during imbibition, thereby leading to increased germination under controlled environment conditions (McWilliam and Dowling 1970; Cook 1975). However, the germination response to coating in the field has been variable. Vartha and Clifford (1973) obtained a 2- to 4-fold increase with Lolium perenne, Dactylis glomerata and Holcus lanatus, but Dowling (1978) obtained no response with a range of temperate legume and grass species. Similarly, Hull et al. (1963) concluded that coated seed had no advantage over non-coated seed for grass establishment on western rangelands of the USA. However, the work of Scott and Hay (1974), Scott (1975) and Cook and Dolby (1981) indicated that coating can result in increased establishment of surface-sown seed under a narrow range of near-limiting water tensions, particularly where the seed is unprotected by surface cover, but the effect is likely to be small. Coating is therefore likely to have even less effect where the seed is covered by soil.

Seedling emergence phase

Radicle emergence is believed to correspond to the start of cell division in the embryo of grasses and represents the 'point of no return' in terms of survival (Hopkinson 1993). Seedlings are at one of their most vulnerable stages between radicle emergence and the time when their roots access the safety of moisture stored in the soil. It becomes a race between the drying front of the soil and the downwards growth of the seminal root seeking safety in the soil moisture stored below. It is therefore advantageous to sow seeds as deep as emergence limitations will permit in regions where the soil dries rapidly following rain and/or where rainfall is erratic. Lack of soil moisture is one of the main factors affecting seedling emergence and many seedlings are lost through desiccation at this stage. The presence of adequate moisture reserves within 5–7 cm of the soil surface is therefore considered critical for the emergence and survival of seedlings.

Depth of sowing

The advantages of placing seed in the soil, compared with sowing it on the surface, have been discussed from a germination viewpoint above. The emerging radicle is also better protected from desiccation when the seed is below the soil surface. Drilling seeds into the soil at the optimum depth for the species being sown therefore provides the best conditions for germination and seedling emergence. However, more seed is probably wasted by planting too deep than too shallow, especially when the conditions required are not well understood. The optimum depth of sowing varies from species to species, and between sandy and clay soils. Nevertheless, most small-seeded pasture species have optimum planting depths of only 10–20 mm (Cook et al. 1987; Loch et al. 1999), with emergence failing completely if the seed is placed deeper than 50–60 mm. Larger-seeded legume species like siratro (Macroptilium atropurpureum), lab lab (Lablab purpureus) and leucaena (Leucaena leucocephala) are exceptions and can be planted to about 50–70 mm deep with some safety.

Soil physical impediments to emergence

Rapid drying of the surface of self-mulching clay soils has been shown to reduce the emergence of small-seeded grasses such as green panic and rhodes grass (Chloris gayana) from cultivated seed-beds in southern Queensland (Leslie 1965). Emergence failures were attributed to 2 characteristics of these soils as they dried out: the mechanical impedance by dry soil crumbs beneath the surface crusts; and the penetration of light into the soil, which resulted in the exertion of the primary leaf from the coleoptile while it was still below the soil (Leslie 1965). Furthermore, surface sealing, crusting and poor soil tilth can also be problems on heavy clay soils that are sodic and where organic matter has been depleted. Application of gypsum will reduce such problems, but the economics of such a strategy are questionable over large areas. Some of the harder-setting loamy soils, with depleted organic matter levels, can also inhibit seedling emergence by sealing over during heavy rain. The impact of many of these physical barriers to emergence can be reduced by reducing the rate of drying of the soil surface with the aid of surface mulches.
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(Landholders with soils displaying any of these problems need to plan well ahead in order to develop surface cover and mulches prior to the planting operation.

Seedling growth and survival phase

This phase starts once seedlings have emerged from the soil. Once the young seedlings are exposed to the often hot and drying conditions above the ground, even greater emphasis is placed on the developing root system to find and exploit supplies of soil moisture. The low levels of organic matter and associated fertility, as well as the physical degradation of the soil found in old cropping areas, can also reduce plant growth (Roe 1974). Competition from weeds can also be a major factor influencing growth and survival.

Soil moisture

Since we operate in a region with variable and erratic rainfall where dry periods are common, it is not surprising that soil moisture plays such an important role in the growth and survival of a young pasture. Risk of establishment failure can be markedly reduced if the seed-bed into which the seed is sown has a reasonable store of moisture at the time of planting. While there are few studies that have examined establishment risk with pastures, a number of modelling studies by the APSRU Group have shown (Whish et al. 2005; 2007) that the risk of field crop failure is significantly diminished as the amount of moisture stored in the soil profile at sowing time increases. The amount of water stored in the soil at planting does not need to be as much as with crops, but there still needs to be adequate moisture for seedlings to survive and grow for a reasonable time without follow-up rainfall. Hence, for establishment of most grasses I would consider a 30–50 cm band of moisture that is close to field capacity to be quite reasonable insurance against dry weather, with the top of this moisture band being within 5–7 cm of the surface at the time of sowing. For clay soils, this approximates to 40–60 mm of plant available water.

Nutrients

The fertility of most old cropping ground has been depleted, through both nutrient export in grain, hay and silage, and loss through erosion in sloping country. Organic matter levels are one of the first to suffer, particularly in areas where conventional farming practices have been used for long periods. A reduction in organic matter limits the ability of the soil to mineralise sufficient nitrogen for grass growth and so legumes that are capable of ‘fixing’ and supplying nitrogen may need to be considered for the long-term stability and production of the pasture. Phosphorus and sulphur tend to be more important for the growth of legumes and must be applied where they are deficient, to ensure the legume grows well enough to ‘fix’ sufficient quantities of nitrogen for pasture growth. Seed production, and hence persistence of annual legumes such as the medics (Medicago spp.) and subterranean clover (Trifolium subterraneum), will also be compromised if nutrients are deficient.

Adequate nutrition is critical for the early growth of seedlings. For example, McWilliam et al. (1970) showed that fertiliser phosphorus was absorbed as early as 4 days after the start of imbibition. Lucerne (Medicago sativa) and subterranean clover seedlings grown in perlite and sand under conditions of controlled environment, and receiving nutrients, were significantly heavier than those receiving only distilled water as early as 5 days after starting imbibition. Phalaris and perennial ryegrass seedlings showed a similar response 6 days after the start of imbibition and the differences in growth of both the legume and grass seedlings increased markedly with time. When nutrients were withheld, a reduction in root elongation was evident 5 days after the beginning of imbibition. Furthermore, under field conditions in southern Queensland, Cook and Ratcliff (1985) showed that, 1 day after seedling emergence, siratro seedlings fertilised with superphosphate and nitrogen at sowing were larger than those receiving no fertiliser. McWilliam et al. (1970) also suggested that the endogenous seed reserves, at least in ryegrass seedlings, appeared to be utilised by about 10 days after germination. This would suggest that fertilisers should be placed where they are readily accessible to the young seedling in order to gain maximum benefits in growth rates that are considered necessary for survival following emergence.
**Plant competition**

Seedlings are most vulnerable to competition during the first 3 months of life, when their root systems are developing to a stage where they are more resistant to dry weather. During this time, root competition for water and nutrients has a greater influence on seedling growth than competition for light (Cook and Ratcliff 1984; 1985). Control of such competition by grazing management is generally not effective as it fails to adequately control root competition (Cook and Ratcliff 1984). Establishment success therefore depends largely on how strong the root competition is, and the extent to which it suppresses seedling growth.

Many of the old cropping cultivations into which the pastures are being sown contain annual grass and broadleaf weeds. Weed species like liverseed grass (*Urochloa panicoides*), barnyard grass (*Echinochloa* spp.), mintweed (*Salvia reflexa*) and *Amaranthus* spp., inter alia, are common in old cropping areas. Generally these weeds are very aggressive, are characterised by high growth rates and relatively short life cycles and set large quantities of seed. They establish faster than, and completely dominate, the slower-establishing and slower-growing perennial pastures that are being sown. Competition is primarily for water and nutrients, and is often so intense that high populations of these weeds can lead to complete or partial establishment failure. The poor stands that develop following partial failures may take many years to thicken up and reach their production potential, if in fact they ever do. Since it is not possible to control this competition through grazing, measures need to be taken to reduce or control these annual weeds before the pasture is sown. It is possible to reduce the seed-bank of the annual grasses, fleabane (*Conyza* spp.) and common sowthistle, by around 99% within 2–3 years, if certain management practices are followed (Walker et al. 2007). Similarly, a reduction in the soil seed-banks of other broadleaf weeds with more persistent seeds, such as bladder ketmia (*Hibiscus trionum*), climbing buckwheat (*Fallopia convolvulus*) and turnip weed (*Rapistrum rugosum*), can be achieved in 4–5 years. Such management requires timely weed control that prevents any seed-set by the weeds during the run-down period and the avoidance of tillage methods that invert the soil and bury the weed seed greater than 2 cm (Walker et al. 2007).

**Conclusions**

*Establishing the base population — a numbers game*

The principles of pasture establishment are similar to those for establishing a crop. One needs to establish a base population of plants that will develop into a productive pasture. For most tropical tussock grasses, this means achieving a population of at least 6–8 mature plants per square metre 1 year after sowing. Years of research and commercial experience have shown that there is a need to sow 2–4 kg of grass seed per hectare to achieve, or preferably exceed, this population objective. When one considers that many of our pasture grasses contain between 1.6 and 4.4 million seeds per kg, this is equivalent to sowing 300–600 seeds per square metre. However, a proportion of this seed is likely to be immature, dormant or sterile and seed samples of the lighter chaffy grasses also contain inert matter (e.g. straw, stalks, cracked seed, grass florets and spikelets, grit, dead insects, etc.) (Butler 1999; Hopkinson and English 2005). Even considering just the germinable seed fraction, losses in potential numbers occur during each of the 3 main phases of establishment. Field germination of grass seed is commonly only 25–50%, even with good quality seed and, of this, only 20–40% germinates and emerges in the field, even under good conditions. Even greater losses can occur during the seedling growth and survival phase where the young seedlings need to survive adverse weather conditions, competition from weeds and insect attack.

The quality of the seed being sown is something over which it is possible to have reasonable control, so it is always advisable to obtain a laboratory report or certificate for the seed lot concerned before sowing the seed. Even though seeding rates can be increased to compensate for seed of low germination, it is generally not advisable to buy seed that has a low germination, as this may be an indicator that the seed also lacks vigour, thereby compromising field performance (Hopkinson and English 2005). Attention to detail during seed-bed preparation and seed placement during sowing can also have a large impact on the establishment outcome.

*Planning for pasture establishment*

Planning for pasture establishment is extremely important and ideally should start at least
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12–18 months before the anticipated planting date. For example, what legumes will be sown, when will they be planted? Is fertiliser required? Soil testing to determine the nutrient status of the soil should be carried out well before planting so that a fertiliser program can be planned, if necessary. Stubble cover may need to be managed, both to facilitate water infiltration and to create a more favourable environment for germination and emergence. Paddocks containing soils that are hard-setting and restrict water infiltration may need ripping to facilitate water entry. Ripping on 60–100 cm centres with a heavy-duty chisel plough fitted with narrow points has worked well on a number of hard-setting loamy soils. Full cultivation of such soils often leads to surface-sealing and reduced infiltration during heavy rain, especially where organic matter levels have been depleted. Planning becomes particularly important if the paddock to be sown has a significant weed population.

There is little point in sowing pasture species and varieties that are not adapted to the environment and soil type (Lloyd et al. 2007). It may not always be possible to obtain seed of the preferred species and varieties at short notice, so seed acquisition needs to be included in the planning phase of pasture establishment. This should also ensure that freshly harvested seed does not have to be planted.

**Time of sowing**

Pastures should be sown at a time when there is greatest chance of achieving success. Such decisions are based on building a profile of soil moisture, weed control and seasonal temperatures. It is best to sow pastures at a time of year when temperatures are favourable for growth and there is greatest chance of getting follow-up rain within 5–10 days. This generally occurs during the summer months in southern Queensland. Since the surface layers of soil dry rapidly, particularly following disturbance by cultivators or planting machinery, it is generally not possible to establish pasture species on moisture stored in the seed-bed, such as is the case with larger-seeded grain crops like wheat. Rather, it is often better to sow seed into the dried surface layer of a soil, which has received enough rain to provide 30–50 cm depth of good moisture close to field capacity within 5–7 cm of the soil surface. Germination is then stimulated by the next fall of rain. All tropical pasture species are susceptible to frost and so need to be sown during summer months when temperatures are favourable for growth. This will ensure that they reach a minimum critical size before being frosted. On the other hand, medics and subterranean clover are cool season plants that grow over the winter and spring months. They should therefore be sown onto a profile of moisture in late autumn or early winter to give them time to become established, grow and set seed.

An ideal time to sow medics is with the final crop of wheat. The development of a moisture profile for the grain crop normally ensures that the medics will have adequate moisture for growth and seed-set. However, seeding rate of the wheat crop should be reduced to around 20 kg per hectare in order to reduce competition from the wheat and allow the medics to grow and produce adequate seed. Alternatively, the medics could be oversown into grass pastures after the grasses have been established. This should be done in late autumn or early winter on an opportunistic basis when the seasonal outlook for rainfall is favourable. Medic seed should never be sown in summer when the tropical grasses are sown, as it is too hot for medics to establish and grow.

**Sowing methods**

As mentioned earlier in this paper, best conditions for germination and emergence are likely to be provided by drilling seed into the soil at the optimum depth for the species being sown. However, the lack of suitable machinery for both the metering of light, chaffy seeds, or with suitable precision for sowing small-seeded species means that many pastures are sown by broadcasting the seed onto the surface of a cultivated soil, often followed by light harrows or a roller. Such methods can work reasonably well, but it is important that the soil be freshly cultivated prior to sowing and that the seed not be dropped onto a soil that has been consolidated by rain, wind or livestock. Seed-beds should not be worked too fine or the soil surface may seal over during rain, especially in old cultivations where much of the organic matter has been depleted. On the other hand, it is also important that seed-beds are not too rough and cloddy to the point that many small seeds would lodge under large clods or fall into crevices or deep furrows only to be covered too deep following harrowing, rolling or heavy rain. Rough seed-beds may
be caused by insufficient preparation or leaving deep furrows following the use of chisel ploughs fitted with sweeps. Sowing seed behind blade ploughs, which are primarily intended for woody regrowth control, tends to be unreliable because of poor seed placement and the blade ploughing operation also tends to dry the top 20–30 cm of the soil, thereby destroying any moisture profile that might have been present. Furthermore, the blade ploughing operation is generally carried out at a time designed to maximise regrowth control, not pasture establishment.

It is often desirable to build up and retain as much stubble cover as possible on the soil surface where it will provide the greatest benefit. The use of harrows and rollers may not be advisable if they are likely to reduce or destroy the stubble cover present. Cultivation methods that retain stubble on the surface of the soil followed by prickle chain harrows to help incorporate any seed that is broadcast onto the soil surface may be a preferable option where stubble management is critical. Where feasible, the use of zero till machinery that provides little disturbance would also be a good option.

One of the problems with trying to drill small-seeded species is that many commercial seed drills do not have adequate depth control to consistently place seeds at the shallow depths required, especially if the soil surface is uneven. One option is to take the seed tube from the sowing boot and drop the seed into the trench behind the boot, before pressing it with a press wheel. The use of press wheels in this way will both bury the seed in the top 10–15 mm and firm the soil around the seed, thereby enhancing soil-seed contact (Cook et al. 1992). However, it is difficult to sow pastures such as creeping bluegrass and rhodes grass into the soil because they have light chaffy seeds that are almost impossible to meter through normal seed-box mechanisms. Seed coating does allow these light chaffy seeds to be metered through seed-boxes, but the value of commercial seed coating in this role must be questioned because of the high price of coated seed. For example, the ratio of coating material to seed ranges from 2:1 to 10:1, and is commonly of the order of 5:1. Therefore, either field establishment needs to increase proportionately as a result of coating, or seeding rates of the coated seed will need to be increased in order to compensate for the reduction in seed numbers per unit weight. Yet the price of coated seed is commonly 65–70% of the cost of uncoated or bare seed. A better option would seem to be finding a seed-box that is capable of metering light chaffy seeds. A number of these have been developed over the years by small engineering operators, who possibly may have lacked the development and marketing expertise to have them more widely accepted.

Some farmers, who have adopted many of the principles and guidelines based on zero tillage techniques outlined above, report that they have been able to achieve similar results to seed broadcast onto the surface of a cultivated seedbed and rolled, with only 25% of the seeding rate. Such reports should provide incentive for seeking better ways to establish pastures. Single disc seeders that have individual planting units arranged in a parallelogram configuration are becoming more common in cropping areas. Many of these machines appear to have the capability of placing pasture seed at the consistent shallow depths required and then pressing the soil around the seed with a press wheel. There are also companies that make undercarriages containing this type of unit for older style combines. These machines are capable of sowing direct into stubble with minimal disturbance. Seed-boxes capable of metering difficult seeds should be investigated further so that key establishment principles are not compromised through the use of other methods.

References


