

Introducing white clover into existing swards and getting variety choice right

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In a previous issue of Organic Matters, the establishment of grass-clover permanent pastures using ploughing or minimum cultivation equipment was discussed. In this article Dan Clavin and Stephen Nolan, Teagasc, Athenry discuss the benefits of broadcasting white clover into existing swards and seed variety selection.

Clover - the home grown fertilizer factory

Clover is a home grown natural fertilizer factory. For organic farmers, white clover is the main driver of productivity in grassland swards. A productive sward can fix in the region of 100 - 150 kg Nitrogen/ha/year. This can result in a saving of €150/ha (€60 per acre) compared to conventionally fertilized non-clover pastures.

Around 79% of the earth's atmosphere is in the form of inert N gas. This N is of no use to plants unless it is converted into a form that is available to plant roots in the soil. *Rhizobia* bacteria which live in nodules of the clover root, have the ability to convert atmospheric-N into ammonium-N.

White clover spreads across the ground through "stolons", which produce edible leaves and flower heads at low levels. This makes it highly suitable for grazing. Clover-rich swards enable higher stocking rates and lead to increased animal intakes. The addition of white clover to swards increases protein and mineral content and helps maintain sward digestibility throughout the year. Growing clover also significantly improves the environmental impact of farming.

On an economic basis, 1 kg of un-pelleted white clover costs around €10 and if you are spreading 5 kg per hectare (2 kg/acre) on 20% of the farm every five years (clover will last 3 – 8 years depending on management) then the cost is just €10/ha/year.

Full-reseeding v Broadcasting

It has been pointed out in a previous article that a complete re-seed can cost around €600/ha (€250 per acre). This option is considered the best means of getting clover into a sward especially in a dense pasture eg. sheep pastures or old butty pastures with little possibility of the clover seed achieving an adequate soil seed-contact to make a “hit” and germinate.

Broadcasting clover seed into existing pastures on the other hand, offers a cheaper method with a 75% success rate at farm level, but the management of the sward before and after over-sowing is the key to success.

Sowing essentials

Successful establishment of white clover in the sward by over-sowing depends on:

- a) Contact between the soil and the seed to make a “hit” and allow germination
- b) Moist soil conditions
- c) Light penetrating down to the clover seed and seedlings; and
- d) Strong well-established seedlings to survive the Winter

Methods of over-sowing

Techniques using strip or slot-seeders are not recommended because they increase costs without improving the rate of successful clover establishment. Strip or slot seeders or scratching the soil surface with a harrow can also damage the sward and open it up to weed infestation. To that end, broadcasting methods using a standard fertilizer spreader or other specialised broadcasting equipment such as an air-seeder etc. are recommended. Putting clover seed into a slatted tank and then spreading the slurry is not a reliable method of getting even application of clover seed.

Time of over-sowing

Experience on farms and at Teagasc Solohead, Tipperary has shown that, in general, over-sowing works best after a harvest of silage during May or early June, compared to spreading on grazed swards. This is mainly because the grass recovers more quickly after grazing than after a silage cut, thus competing against the slower establishing clover seedling. Over-sowing in most years should really take place before late June. Over-sowing will be most successful in wet summers, in heavy rainfall areas in the West of the country and on heavier soils. Over-sowing is somewhat riskier on drier sandier soils in Eastern parts of the country and really should be carried out in May in these areas.

10 steps to successful clover over-sowing

1. Reseed with 5 kg of white clover seed per hectare. It is vital that organic clover (~€15/kg) or non-pelleted (naked) conventional clover (~€10/kg) is used. Pelleted clover which often contains artificial phosphorus (P) is **strictly prohibited** according to organic standards.
2. Ideally take a heavy cut of silage off the field and cut it very low to stunt the grass and make the sward as open as possible. Tight grazing over a long period is also an option before over-sowing.
3. Mix the clover seed with a mixing agent. Common mixing agents commonly used on organic farms are dry sand, granulated lime products or permitted natural granulated fertilizers (eg. sulphate of potash). Mix it in the field rather than in the yard and only mix half the amount first (each acre is spread twice – in two opposite directions). Spread about 5 to 10 acres at a time.
4. Spread and then spread the same area again in the opposite direction. See graph.
5. Once the clover is spread, apply around 2,000 - 3,000 gallons per acre (33 m³/ha) of fairly watery cattle slurry to the silage stubble. This helps to wash in the seed which aids germination and seedling establishment as well as supplying nutrients for plant growth.

6. Be back grazing that field within 24 days – this is very important.

7. Thereafter graze very tight each time (to 4 or 5 cm – to prevent tall grass shading out clover) and graze every 24 days. This is why lowly stocked farms may have difficulty getting clover established. Clover stolons will spread much greater distances once they have light reaching them.

8. If the ground becomes too dry do not over-sow.

9. Another option is to graze out a field with light cattle (to 4 cm or less). Spread the clover seed and then within a short period put more cattle on the field to re-graze it out again. The cattle will then walk the seed in.

10. Tight grazing is essential -

- Down to 4 cm between turnout and mid-April
- Down to 5 cm during the main grazing season
- Graze the sward to 4 cm before it is closed for the winter
- Do not have very heavy covers over the winter – if you do, get them grazed by early March

Experience of over-sowing white clover at Teagasc

Over-sowing has been used at Teagasc Solohead and Athenry research farms for years both to increase and maintain the white clover content of the swards. It has mostly worked well. Poor results have occurred when dry weather and soil conditions follow over-sowing. Over-sowing at Solohead has generally been between 70 and 80% successful over the years. Poor results have also been due to allowing grass get too strong after over-sowing. This is the single biggest factor for failure that lies within the farmer's control. The importance of tight grazing after over-sowing cannot be overstated. The single most important

recommendation, which can greatly improve the success of over-sowing, is tight grazing for the remainder of the year.

Recommended white clover varieties

Each year DAFM produces a list of recommended grass and white clover varieties. These varieties have been trialled and evaluated over a minimum of two separate sowings in Kildare, Galway, Cork, Donegal and Kilkenny. The DAFM recommended list for 2015 is presented in Table 1 below. The Northern Ireland recommended list is more comprehensive and is also of relevance.

White clover varieties are classified by leaf size

Smaller leaf varieties are generally lower yielding but more persistent than large leaf varieties and so are recommended for sheep farms. Small-leaf clovers survive the selective grazing of sheep because their stolons are small and close to the ground. Medium leaf varieties are intermediate in terms of yield and persistency, making them suitable primarily for grazing but also for silage.

Cattle and dairy cows are less selective grazers and graze less close to the ground than sheep. Therefore small-leaf cultivars are more at risk of being shaded out of a sward grazed. Large-leaf cultivars grow more aggressively and are better able to compete in swards grazed by cattle.

Table 1 DAFM Recommended White Clover Varieties 2015

Variety Name	Total Yield	Leaf Size*	Clover %	Year 1 st Listed	Breeder	Origin
Control Mean: <i>(t DM/ha)</i>	9.1					
Barblanca	103	Large (0.78)	50	2009	Barenbrug	NL
Alice	102	Large (0.76)	49	1995	IBERS	UK
Chieftain	100	Medium (0.68)	47	2005	Teagasc	IRL
Buddy	101	Medium (0.63)	45	2015	Teagasc	IRL
Avoca	103	Medium (0.61)	47	1995	Teagasc	IRL
Iona	96	Medium (0.59)	47	2014	Teagasc	IRL
Crusader	96	Medium (0.57)	44	2009	Barenbrug	NL
Aberherald	98	Medium (0.55)	45	2003	IBERS	UK

*In the table above varieties are listed in order of decreasing leaf size. *Values in brackets indicate leaf size compared to the variety Aran (i.e. Aran = 1.00), based on data from UK D.U.S. tests.*

The Northern Ireland recommended varieties list includes all of the above and adds seven varieties, including some small leaf (AberAce and Grasslands Demand) and very large leaf (Aran and Triffid). The addition of Buddy to the Northern Ireland list is expected this year.

The main features of each variety are highlighted below. These features should be used as the basis of choosing the varieties of clover suitable to each enterprise type.

Barblanca is a large leaved variety with very good annual yield, with highest productivity in spring and autumn. Considered suitable for silage production but unsuitable for hard grazing.

Alice is a large leaved variety with high total sward and excellent clover yields throughout the growing season. Considered suitable for silage production but unsuitable for hard grazing.

Chieftain is the largest of the medium leaved varieties, with good yield and persistency making it suitable for grazing. It is also considered most suitable for dual purpose mixtures.

Teagasc Research Officer Dr. Patrick Conaghan highlights the new variety '**Buddy**' as high yielding, with outstanding ground cover for its leaf size, and outstanding spring growth.

Avoca is a medium leaved variety with very good yield and a very high grazing persistency for its leaf size. It competes well with the accompanying grass, leading to high clover content in the grazing diet.

Iona is a medium leaved variety with high yield and persistency, which competes well with the accompanying grass. It is considered suitable for grazing.

Crusader is a medium leaved variety with very high yields and persistency with exceptional spring vigour for its leaf size. It is considered suitable for grazing.

Aberherald is the smallest of the recommended medium leaved varieties. It performs particularly well in late summer, but has good persistence and clover content throughout the season. It is considered suitable for grazing.

Clover blends depend on enterprise

In general 2 varieties of clover are used in a mix. A combination, one from large, medium or smaller leaved varieties can lead to more successful establishment of clovers and can also allow for more flexibility of management. Some factors to consider when choosing a clover mix include yield, persistency and optimum growing season.

For sheep a suitable mixture of clover cultivars could contain Avoca and Aberherald. The emphasis of this blend of clover cultivars is more on persistence than yield.

For beef and dairy swards, a suitable mixture could contain Chieftain and Buddy. This blend is targeted more towards yield rather than persistency.

If the ley is to be used for the dual purposes of grazing and hay/silage, then a mixture of Chieftain and Barblanca could be used.

Finally, for silage-only leys the larger leaved clovers are most suitable, but could be mixed with a 3rd variety eg. Buddy or Avoca to ensure good growth and cover throughout the season.

Some management pointers

As white clover needs light to survive the winter, keeping swards well grazed in late autumn and spring makes a big difference to clover survival and productivity during the following growing season.

The Rhizobia bacteria associated with clover perform best in soils with good levels of phosphorus (P) and potassium (K) and high lime status and therefore white clover does not grow very well in acid and, in particular, peat soils.

White clover can be expected to perform best and make the greatest contribution to pasture productivity on free-draining loamy soils. These soils are light and therefore warm up relatively quickly.

Under normal circumstances the clover content declines slowly and virtually disappears from the sward over time. However, there is a large residual impact of clover on soil fertility. Even as the clover content of the sward declines to low levels, sward productivity can subsequently remain very high for a year or two. This is due to the residual (slow-release) impact of the clover on soil N supply.