

# Benefits of white clover in grass-based milk production systems

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## Summary

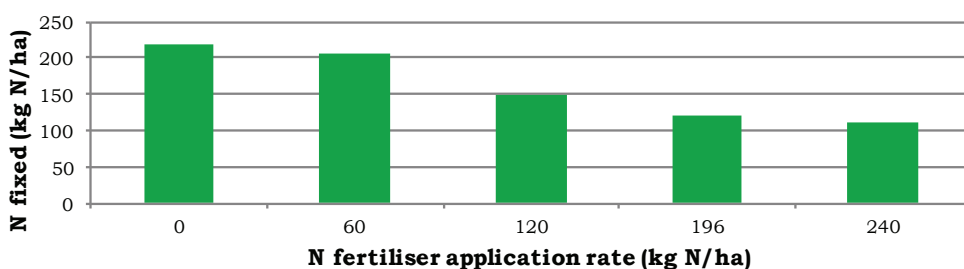
- Grass-white clover swards can fix 100–250 kg nitrogen/ha/year.
- Incorporating white clover in fertilised grass swards can increase herbage and milk production.
- Reducing N fertiliser application to grass-white clover swards can increase N use efficiency of the farm system.

## Introduction

White clover is the most commonly sown legume species in temperate grassland. White clover grows well in association with grass. It is tolerant of grazing and can grow over a fairly wide range of climatic conditions. There are several benefits associated with the use of white clover in grass-based milk production systems.

## Nitrogen fixation

White clover can fix nitrogen (N) from the atmosphere and make it available for plant growth. Rhizobia bacteria live in nodules on the roots of the white clover plant and exist in a symbiotic relationship with the clover whereby they fix N making it available for plant growth using energy provided by the clover plant through photosynthesis. Many experiments have been undertaken examining the quantity of N fixed in grass-white clover swards. In frequently grazed swards (8–10 times/year) up to 250 kg N/ha per year can be fixed. The rate of N fixation is influenced by the N fertiliser supply to the sward and the sward clover content. Generally, an average annual sward clover content of at least 20% is required for N fixation. In fertilised swards, as N fertiliser application rate increases, N fixation generally declines (Figure 1).



**Figure 1.** Nitrogen fixation (kg N/ha) on grass clover swards receiving 0, 60, 120, 196 and 240 kg N fertiliser/ha over three years

## Herbage production

Incorporating white clover into grazed grassland can increase herbage production, particularly at lower N application rates. Research from Clonakilty Agricultural College found that incorporating white clover into intensively managed swards increased annual herbage production by 1.2 t DM/ha, on average, relative to grass only swards (where both

sward types received 250 kg N/ha) over a four year period and where sward clover content was 23%. Research at Moorepark shows that grass-white clover swards receiving 150 kg N/ha grew the same quantity of herbage as grass-only swards receiving 250 kg N/ha (13.5 t DM/ha).

### Milk production

Grass-white clover swards tend to be higher quality in mid-season compared to grass-only swards as sward clover content increases from May onwards. Clonakilty and Moorepark research both show increases in milk and milk solids production from grass-white clover swards compared to grass-only swards (Table 1).

Table 1. Effect of white clover inclusion on milk and milk solids yield in the Moorepark and Clonakilty grazing experiments			
Moorepark Experiment	Grass-only 250 kg N/ha	Grass-clover 250 kg N/ha	Grass-clover 150 kg N/ha
Milk yield (kg/cow)	6,108	6,498	6,466
Milk solid yield (kg/cow)	460	496	493
Clonakilty experiment	Grass-only 250 kg N/ha	Grass-clover 250 kg N/ha	
Milk yield (kg/cow)	5,222	5,818	
Milk solid yield (kg/cow)	437	485	

### Nitrogen use efficiency

Nitrogen use efficiency is hugely important in grazing systems as N is a key nutrient lost from our systems. It is influenced by many factors including N fertiliser application rate, quantity and crude protein content of concentrate fed and N removed from the system in milk and meat. The N use efficiency of a farm systems experiment undertaken at Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork from 2013 to 2016 was examined using a farm gate N balance model. The experiment compared herbage and milk production from a grass-only sward receiving 250 kg N/ha per year (Grass250) and grass-clover swards receiving 250 or 150 kg N/ha per year (Clover250 and Clover150, respectively). Each treatment was stocked at 2.74 cows/ha. The N inputs were purchased concentrate, fertiliser and replacement animals, and the N outputs were milk and livestock. The N fixed by the clover was not included. The N use efficiency of the systems increased from 40% on the Grass250 to 59% on the Clover150 due to the reduction in N fertiliser application and the increase in milk production (and therefore increased N in milk) on that treatment.

### Conclusions

Incorporating white clover in grass-based systems can increase herbage production and animal performance at grazing and can contribute to reduce N fertiliser application thereby improving N use efficiency of farms.