

Optimising N, P & K for Grass Silage

Mark Plunkett, Teagasc, Johnstown Castle, Wexford

It will be time to consider closing up silage fields over the coming days / weeks to ensure that enough grass silage is produced to meet the winter feed requirements of the animals on the farm. Plan to maximise both grass silage yield and quality to help reduce the costs associated harvesting and ensiling the grass and to offset some of the concentrate feed costs. Careful fertiliser management is required to ensure that maximum grass yield & quality is achieved at harvest time. These target harvest dates are important in order to achieve the desired silage quality required for the livestock production system. Where silage crops are lighter than expected, there is often a temptation to allow the grass to grow and “bulk up” for an additional couple of weeks, however, this can often have detrimental effects on silage quality. In this article I will look at the N, P & K requirements for a high yielding grass silage sward.

Soil Analysis

The starting point is to check soil test reports to identify the fertility status of the silage fields. This will provide information on soil pH and lime requirement and the major plant nutrients P and K. Soil test results are the basis for making the right slurry and fertilizer application decisions in order to deliver the correct balance of N, P and K for yield. On average silage fields tend to have lower levels of P and K for a number of reasons. Firstly, these fields are continuously cut for silage, thus large quantities of P and K's are removed each year, and secondly, these fields tend to be furthest from the farm yard and may not receive an annual application of organic manures due to the longer travel distances.

Nitrogen (N)

Nitrogen is the key driver of yield but too much N in the grass at harvest will make it difficult to ferment properly as it reduces the grass sugar levels and dry matter content. In contrast too little N will reduce grass growth and overall yield and delay harvesting date. Grass swards with high levels of perennial rye grass will use N more efficiently than older swards. Recently reseeded swards (0-3 years) will have 25% higher N demand, especially when reseeded after a tillage rotation. First cut grass silage (5 to 6t/ha of DM) will require 125 to 150 kg N/ha (100-120 units/acre). The grass silage crop will uptake, on average, 2.5kg/ha/day of N (2 units / day). Therefore, it is necessary to apply the N fertiliser at least 50 days before harvesting to ensure full N utilisation.

- Where fields received early N applications for grazing assume 30 to 50% of this N will be available and deduct from the above N total for the silage crop.
- Reseeded swards will respond better to N than old permanent swards.

Phosphorus (P) and Potassium (K)

Phosphorus and potassium are essential to maximise grass yields therefore adequate supply of these nutrients in the soil is critical. Assess the most recent (< 5 years) soil test reports to determine the P and K requirements for silage fields. A crop of grass silage will remove

approximately 4kg P and 25kg K /tonne of grass dry matter (DM). A 5t/ha DM crop (fresh grass silage yield of ~10 tonnes/acre @ 20% DM) will remove 20kg P/ha and 125kg K/ha at harvest time. Where insufficient P and K are applied for silage swards, soil P and especially K levels will decline rapidly due to the high off-takes of these nutrients in the silage crop.

Organic Manures

Organic manures are an effective source of N, P & K and can provide a large proportion of crop P and K requirements at relatively low cost. Table 1 shows the available N, P & K content for a range of organic manures.

Table 1:-Available N, P K values for a range of organic manures			
Manure type	N	P	K
kg/m³			
Cattle Slurry (7% DM)¹	0.7	0.6	3.3
Dilute Cattle Slurry (3.5% DM)¹	0.6	0.3	1.65
Pig Slurry (4% DM)	2.1	0.8	2.2
kg/tonne			
Farmyard manure (FYM)	1.35	1.2	6
Spent mushroom compost (SMC)	1.6	1.5	8
<i>¹ Actual N, P & K value for cattle slurry.</i>			
<i>To convert kg/ m³ to units/1,000 multiply by 9. To convert kg/ton to units/ton multiply by 2.</i>			

Cattle slurry is the most common manure applied to silage fields and good quality cattle slurry (7% DM) has the correct ratio of P to K for to match silage crop requirements. Diluting cattle slurry with water is beneficial for ease of agitation and can help to improve the N availability in the slurry; however it will also dilute the P and K content of the slurry.

Table 1 shows the typical available N, P & K values for a typical 7% DM and dilute (3.5% DM) cattle slurry. It is important to take account of slurry DM content when considering appropriate application rates to reduce the risk of under fertilizing silage crops. The slurry hydrometer is a useful tool than can be used to measure the DM% of your slurry and to predict the nutrient content more accurately. Once you know how much N-P-K you are applying in slurry you will be able to select a suitable fertilizer type to complement or top up these nutrients levels to the required levels to maximise grass yield (see table 2).

For example 3,000 gallons per acre of good quality cattle slurry (7% DM) will supply (19 units N, 15 units P & 90 units K) a large proportion of the crops P and K requirements. Cattle slurry contains N which needs to be deducted from the total crops N requirement. Table 2 shows the recommended rates of N, P & K and suggested fertilizer programmes at different soil P & K indexes (1 to 4) required to grow 5t/ha grass dry matter (10 tonnes fresh grass / acre).

- Apply slurry to very bare stubble or short grass
- Where slurry cannot be applied for 1st cut apply after silage harvest.
- Application of cattle slurry with trailing shoe / band spreader will increase N recovery by 0.4 kg/m³.

Table 2:- 1st Cut Grass Silage N, P & K Requirements (5t/ha DM) & Suggested Fertilizer Programmes					
Soil Index	N kg/ha (units/ac)	P kg/ha (units/ac)	K kg/ha (units/ac)	Fertilizer Options^{3,4}	
				No Slurry¹	Cattle Slurry 3,000gal/ac
1¹	125 (100)	40 (32)	175 (140)	4.0 bags/ac 13-6-20 1.75 bags/ac CAN	3 bags/ac 27-2.5-5.0
2¹	125 (100)	30 (24)	155 (120)	3.5 bags/ac 13-6-20 2 bags/ac CAN	3 bags/ac 27-2.5-5.0
3	125 (100)	20 (16)	125 (100)	3.0 bags/ac 13-6-20 2.25 bags/ac CAN	3 bags/ac CAN
4²	125 (100)	0	0	4 bags/ac CAN	3 bags/ac CAN

¹Index 1 & 2 soils apply P & K balance to build soil P & K levels to after grass for example apply as 24-2.5-10 / 0-7-30 / Cattle slurry

²Index 4 soils omit P for 2/3 years & retest, Index 4 K omit for 1 year and revert to index 3 advice thereafter until next soil test.

³Urea can replace CAN as main N source. Moderate rainfall (up to >5 mm) after application will reduce N losses from urea.

⁴For new / older swards with higher / lower yield potential reduce N, P, K by 25 kg N, 4kgP & 25kg K per tonne of grass dry matter (DM)

Timing of N, P & K application

Apply crop N, P & K requirements when closing silage fields in late March / early apply April. Where cattle slurry is applied, delay the top-up fertilizer applications for 1 week. In wetter soil conditions fertilizer N can be split 50:50 for example 50% in late March / early April and the remainder 2 weeks later to reduce the risk of N losses.

Building soil P & K for future silage production

Where the soil P and K status of silage fields has been worn down over a number of years, put a plan in place to build these up and restore their high grass yield potential. Apply additional P and K (soil build-up rates) to index 1 and 2 soils after 1st cut silage, or later in summer. For example fertilizer products such as straight Super P (16% P) or Muriate of Potash (50% K), or compounds such as 0-7-30, 10-10-20, 13-6-20 etc. are very suitable for building soil P and K levels to the target index 3. This strategy will generally take a number of years (moving from Index 1 to Index 3); however this will be rewarded with higher grass

yields of up to 3t/ha extra dry matter which will more cover the extra cost of build-up P and K.

Don't Forget Sulphur (S)

Sulphur deficiency is most likely on light sandy & free draining soils with low soil organic matter levels. Grass silage crops have a requirement of ~20kg S/ha per cut. The application of S to soils where it is required will improve grass DM yields and quality as it helps to maintain an optimum N:S ratio which will improve the efficiency of N use by the grass. Apply S with the main N split as N +S (e.g. CAN +S / Urea +S).