DairyBISS – Research Brief 02

Intensification of hay production on natural Ethiopian pastures through application of manure and synthetic fertiliser

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Fodder availability is an issue in Ethiopia especially in the dry seasons when there is reliance on conserved forage. Hay is the most common form of forage preserved in Ethiopia. There is a growing demand for good quality hay to meet the feed requirements for the most productive part of the huge livestock population in Ethiopia. Currently, hay production is predominantly traditional and dependent on natural pastures. It is characterised by very minimal investments, little or no pasture improvement, and no fertilisation, leading to very low yields. On the other hand, pasture land in Ethiopia is decreasing over the years as it is progressively converted into cropland. This leads to an increasing need for intensification in fodder production.

This study looked at the effects of the application of manure and fertiliser on the yield of good quality hay from natural pastures. Application of small quantities of manure and fertiliser can improve current hay production using small cash investments. While this is affordable to local hay producers, the question at hand is whether these cash investments are cost-effective.

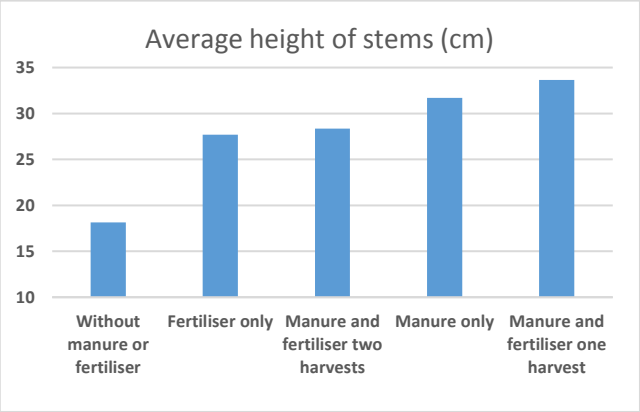
Key messages:

1) The application of either fertiliser or manure or both to natural pasture brings about increases in hay yield that exceed the cash costs for these intensification options.

2) We recommend farmers to apply manure on their hay fields, plus fertiliser if affordable, in order to achieve a sustainable intensification of their hay yield.

3) Farmers intending to benefit from a second hay harvest should apply manure and/or fertiliser early enough during the onset of the rainy season.

A Without manure or fertiliser
B Only manure)
C Only fertiliser)
D Manure and fertiliser, one harvest
E Manure and fertiliser, two harvests



Results

The main results of the study are presented in the figures below:

Figure 1: Average height of fodder stems

Figure 2 shows the average height of the fodder stems two months after the start of the trial. The heights are ranked from the shortest to the tallest. The treatment without manure and fertiliser had the shortest stems, while the treatment with manure and fertiliser with one harvest had the tallest stems.

Based on the leaf length (Figure 2), the treatments without manure and fertiliser and the treatment with manure only were the shortest. These treatments also had the thinnest leaves (Figure 3).

Looking at Figures 1 – 3, we see that the treatment without manure and fertiliser had the worst results while the treatment with both manure and fertiliser had the best results.

Field observations also showed that the leaves of fodder under treatments with manure and/or fertiliser were greener than those without; the latter often were yellowish at the time of harvest. This shows that manure and fertiliser also improved the freshness of grass which could also indicate a richer nutrient content and better palatability of the fodder.

Set-up of the trial

The trial was conducted at Holeta TVET on the natural pasture inside the campus. Two sites were chosen due to their homogenous nature. The trial plots were prepared by clearing the natural grass (mainly *Cynodon spp*.) to a uniform level to avoid bias in results, and by marking small plots of 3x3m dimension ($9m^2$).

The trial followed a 5*4 complete randomised design with five treatments: a) without manure and fertiliser, b) only manure, c) only fertiliser, d) manure and fertiliser (one time harvesting) and e) manure and fertiliser (two times harvesting). Each of these treatments was replicated 4 times. Manure was applied at a rate of 40 tonnes/ha for treatment b, d and e. The full amount of manure was applied at the start of the trial. Urea and DAP fertilizers were applied at the rate of 150 kg/ha and 50 kg/ha respectively in treatments c, d and e. DAP was applied at the start of the trial and urea was applied one month later, except for treatment e, where urea was applied after the first harvest (two months from the start).
Three main measurements were done: grass height, length of leaves, width of leaves and total weight of the forage at harvest from each plot.

Plots prepared for the trial

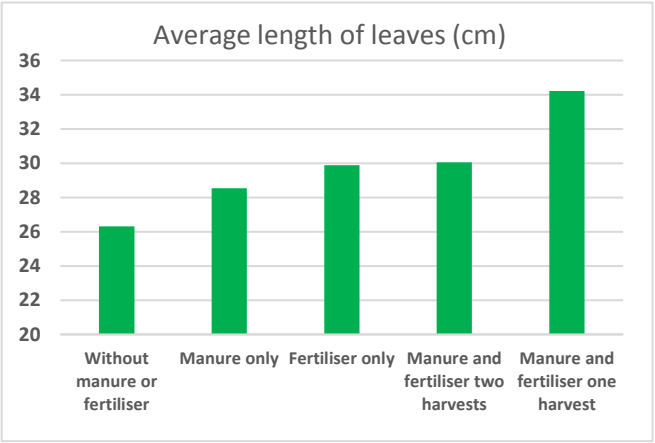


Figure 2: Average length of leaves

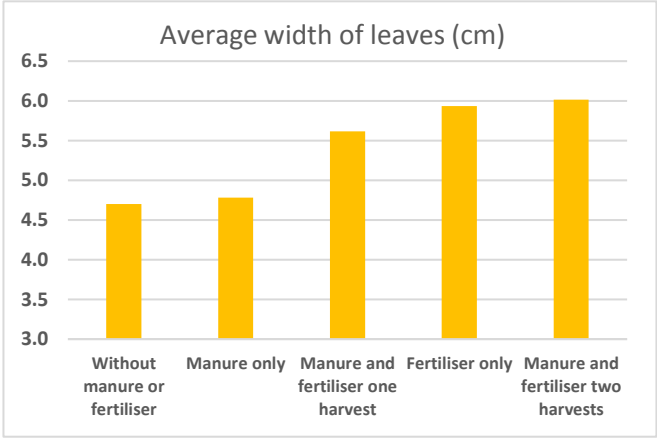
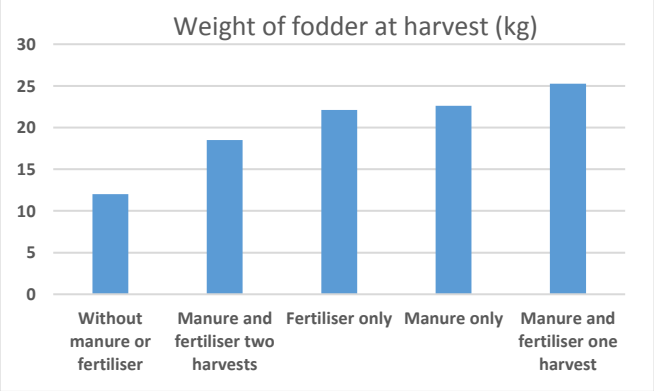


Figure 3: Average width of leaves

Biomass of plants

The average weight of fodder is shown in Figure 4. The average fodder yield of the plots with manure and fertiliser for one harvest was double the average yield for the plots without manure and fertiliser. Meanwhile, the combined yield for the two harvests of the plots with manure and fertiliser had the lowest yield of the plots that had fertilisation. We noted that the trial started one month later than the onset of the rainy season, which particularly affected the results of the treatment with two cuts. It is clear that the yields would be higher if the trials started earlier and allowed for a better interval between the two cuts.

Figure 4: Average fresh weight of harvested fodder per plot



Economic viability

The cash costs for various options were calculated and compared with the value of the additional hay that each hectare of land would produce for each of the treatments as compared to treatment A (without manure and fertiliser). Table 1 shows that all these options were profitable in terms of cash costs, with the combination of manure and fertiliser (one harvest) being the most profitable. The treatment combining manure and fertiliser for two harvests did not yield good results mainly because the experiment started late in the rainy season and the rains were quickly gone after the first harvest. For future trails we recommend an earlier start. The option of applying manure alone seems quite attractive considering that manure is currently available free of charge. However, the time required for manure transportation and application which depends on the farm size and distance have not been considered in these calculations.

Harvesting and weighing of grass for hay

Table 1: Costs and additional income from various fodder treatments compared to no fertilisation

Treatment	A (Without manure or fertiliser)	B (Only manure)	C (Only fertiliser)	D (manure and fertiliser one harvest)	E (manure and fertiliser 2 harvests)
Total cash costs (ETB/ha)	-	-	3,085	3,085	3,085
Fodder yield (tons fresh matter/ha)	13.3	13.8	13.5	15.4	11.3
Fodder yield (bails hay/ha)	611	1,152	1,127	1,286	942
Market value of hay (@ 48 ETB/bail)	29,333	55,306	54,083	61,722	45,222
*Additional income from applying manure and or fertiliser (per ha)	-	25,972	21,665	29,304	12,804

Conclusions

The application of either fertiliser or manure or both to natural pasture brought about increases in hay yield that exceeded the cash costs for these intensification options. We recommend farmers to apply manure on their hay fields, plus fertiliser if affordable, in order to sustainably intensify production and achieve better hay yields.

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