

## New Zealand Society of Animal Production online archive

This paper is from the New Zealand Society for Animal Production online archive. NZSAP holds a regular annual conference in June or July each year for the presentation of technical and applied topics in animal production. NZSAP plays an important role as a forum fostering research in all areas of animal production including production systems, nutrition, meat science, animal welfare, wool science, animal breeding and genetics.

An invitation is extended to all those involved in the field of animal production to apply for membership of the New Zealand Society of Animal Production at our website [www.nzsap.org.nz](http://www.nzsap.org.nz)

[View All Proceedings](#)

[Next Conference](#)

[Join NZSAP](#)

The New Zealand Society of Animal Production in publishing the conference proceedings is engaged in disseminating information, not rendering professional advice or services. The views expressed herein do not necessarily represent the views of the New Zealand Society of Animal Production and the New Zealand Society of Animal Production expressly disclaims any form of liability with respect to anything done or omitted to be done in reliance upon the contents of these proceedings.

This work is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](http://creativecommons.org/licenses/by-nc-nd/4.0/).



You are free to:

**Share**— copy and redistribute the material in any medium or format

Under the following terms:

**Attribution** — You must give [appropriate credit](#), provide a link to the license, and [indicate if changes were made](#). You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

**NonCommercial** — You may not use the material for [commercial purposes](#).

**NoDerivatives** — If you [remix, transform, or build upon](#) the material, you may not distribute the modified material.

<http://creativecommons.org.nz/licences/licences-explained/>

# THE EFFECT ON DAIRY COWS AND SHEEP PERFORMANCES OF ADDITIVES TO HIGH DRY MATTER MAIZE SILAGE

J. B. HUTTON and P. V. RATTRAY

*Ruakura Agricultural Research Centre, Hamilton*

## SUMMARY

In two stall-feeding trials, one with dairy cows in early lactation, the other with mature wethers, the effects were measured of supplementing maize silage at time of ensiling with nitrogen and/or 10 other elements on subsequent dry matter intake, milk production and milk composition, and dry matter intake and liveweight gain, respectively.

The effects of supplementation were greatest with the sheep: dry matter intakes increasing on average by 30%, sufficient to raise the feed value of the maize silage from a maintenance ration to one producing daily weight gains of 110 grams per animal. Compared with unsupplemented maize silage, the addition of nitrogen and minerals produced a 9% increase in the dry matter intake and a 14% increase in the daily FCM production of the cows.

A mixed ration containing 25 to 35% of the dry matter as Tama ryegrass and the remainder as unsupplemented maize silage increased cow intakes and yields of FCM further, but did not increase either the intakes or weight gains of the wethers. FCM yields of cows fed maize silage supplemented with nitrogen and minerals and 25% of the ration as Tama ryegrass were 6% lower than those of others fed to appetite a balanced ration of similar average apparent digestibility.

## INTRODUCTION

In paddock-scale trials over a succession of years, maize crops harvested as high DM silage have outyielded by approximately one-third the DM produced from perennial pastures during the same time under comparable conditions.

Exploitation of this yield advantage depends in part upon discovering ways to improve the feed value of maize silage at minimal cost, since it has been shown with milking cows (Bryant and Donnelly, 1974), and with pregnant ewes (Joyce, 1971), that unsupplemented maize silage as a sole diet will not maintain either milk production or liveweight for these respective classes of livestock.

## EXPERIMENTAL

In the trials to be reported, the effects have been examined on milk production and milk composition of cows, and on live-weight gains of mature wethers, of correcting at ensiling recognized deficiencies in high DM maize silage of nitrogen, calcium, magnesium, sodium, phosphorus and sulphur, and of providing adequate levels of cobalt, copper, manganese, zinc, iodine and iron. Additions of sulphur were mainly in the elemental form; the first four trace elements listed were included as sulphates, iodine as KI and iron as FeCl<sub>3</sub>. Table 1 gives the composition of the maize silage unsupplemented and after the addition of urea, steamed bone flour, calcined magnesite, agricultural salt, and ground limestone.

TABLE 1: COMPOSITION OF MAIZE SILAGE BEFORE AND AFTER SUPPLEMENTATION

Element	% of the DM	
	Before	After
Nitrogen	1.41	2.37
Calcium	0.30	0.78
Magnesium	0.13	0.20
Sodium	0.02	0.17
Potassium	0.96	0.91
Phosphorus	0.18	0.30

In both experiments, sole rations of maize silage (MS) and maize silage + urea and mineral supplements (MS + U + M) were compared with each other and with a third diet consisting of 65 to 75% of the DM from MS and the balance from Tama ryegrass.

In the cow, but not the sheep trial, the effects of increasing the nitrogen concentration alone through the addition of urea (MS + U) were examined, and responses to MS, MS + U, and MS + U + M were measured both with and without Tama ryegrass forming part of the ration. The cow experiment also included a seventh treatment group fed a ration comprising equal parts of maize silage, grass-clover hay, and concentrates. This provided a standard ration on which the performance of all cows was measured also during 3-week periods of uniformity preceding each of the two main experimental periods. Intakes and productions of 28 cows in early lactation were compared during two studies each of three weeks' duration.

*at ensiling?*  
*at feeding?*

TABLE 2: EFFECTS OF GRASS, UREA AND UREA + MINERAL SUPPLEMENTS ON DM INTAKE AND DM DIGESTIBILITY, AND ON MILK YIELD AND COMPOSITION

Item	Treatment						Control	S.E. (d)
	No Grass			Grass				
	MS	MS+U	MS+U+M	MS	MS+U	MS+U+M		
Intake (kg DM/cow/day)	8.0	7.2	8.6	9.3	9.9	10.1	12.1	0.57
DM Digestibility (%)	61.4	—	64.3	66.0	—	67.3	66.4	2.3
Milk (kg FCM/cow/day)	8.3	8.7	9.9	10.5	11.1	11.5	12.3	0.52
Milk protein (%)	2.95	2.98	3.07	3.16	3.26	3.19	3.34	0.06
DMI/kg FCM	0.96	0.83	0.87	0.88	0.89	0.88	0.98	

2.2% of LWT  
= 364 kg LWT

In the sheep trial, 30 mature Romney wethers, averaging 56 kg, were allocated between three treatment groups of equal size. The trial lasted for six weeks.

In both experiments all animals were individually fed to appetite in stalls, and measures were made of the apparent DM digestibilities of the rations. Because of the number of sub-groups involved in the cow trial, estimates of digestibility were made on only five of the seven rations fed. Those excluded were MS + U with and without grass. Three cows or four sheep were used for measuring digestibilities of each diet.

## RESULTS

### COW TRIALS

The most important changes caused by feeding the different supplements in association with maize silage are summarized in Table 2. Means are of both experimental periods.

#### *Intake*

This was lowest for the group fed MS + U and highest for the control group.

Feeding the MS + U + M mixture produced a small increase ( $P < 0.05$ ) in DM intake compared with MS + U, but this was appreciably less than the effect of providing 25% of the total ration DM as Tama ryegrass. Compared with the MS ration, the combination of Tama ryegrass and MS + U + M increased total DM intake by 26%, to within 16% of the control cows. However, supplementation of MS with Tama ryegrass resulted in a 13% lower MS intake than when it was fed alone or in combination with U + M.

#### *Milk Yield*

Changes in FCM production were essentially similar in pattern to those of DM intake; supplementation with grass increasing milk yield much more than urea alone or in combination with minerals. Productions of cows fed Tama ryegrass and MS + U + M were 6% lower than controls. Compared with cows fed MS, the proportionately greater increase in milk yield than in DM intake associated with substitution of Tama for part of the MS ration was due to the significantly higher digestibility of the mixed ration. Digestibilities of the control and mixed MS-Tama rations were essentially similar. Urea and minerals did not significantly affect the apparent digestibility of MS dry matter.

*Milk Composition*

Excepting milk from cows fed MS only which was lower ( $P < 0.05$ ) in percentage fat than that produced by cows on the other diets, changes in milk composition associated with treatments applied only to percentage protein. The trends for percentage protein which were similar to those of DM intake and milk yield were probably largely a consequence of the intake differences.

## SHEEP TRIAL

Effects of supplementing MS with U + M or alternatively with Tama ryegrass are summarized in Table 3.

TABLE 3: DRY MATTER INTAKE AND APPARENT DIGESTIBILITIES OF UNSUPPLEMENTED AND SUPPLEMENTED MAIZE SILAGES, AND LIVEWEIGHT GAINS OF SHEEP

<i>Treatment</i>	<i>Maize Silage</i>	<i>Maize Silage + Urea + Minerals</i>	<i>Maize Silage + Tama Ryegrass</i>	<i>S.E. (d)</i>
Intake (g DM/day):				
Silage	784	1018	585	77
Tama	—	—	317	50
Total	784	1018	902	90
DM digestibility (%)	65.8	67.5	73.5	2.2
Weight gain (g/day)	1	111	91	34

*Intake*

Compared with MS alone, addition of the U + M supplement resulted in a 30% increase ( $P < 0.05$ ) in DM intake, to slightly more than 1 kg/sheep/day. Feeding approximately one-third of a mixed ration as Tama ryegrass reduced MS intake by 25%, but compared with unsupplemented MS alone increased the total DM eaten by 15%.

*Apparent Digestibility of DM Consumed*

Addition of U + M to MS did not affect its digestibility, but inclusion of Tama ryegrass with MS increased ration digestibility by 6 units ( $P < 0.05$ ), and resulted in essentially similar intakes of DDM by wethers in each of the supplemented groups.

### *Weight Gain*

Similarities of DDM intake are reflected in the individual weight gains of approximately 100 g/sheep/day over the 42-day trial period for each of the supplemented groups. By contrast, MS alone was sufficient only to maintain the weight of these 56 kg wethers.

### DISCUSSION

Although there were substantial differences between the designs of the cow and sheep trials, because of the absence of significant interactions between MS and the Tama ryegrass, urea and mineral supplements in the cow trials, several useful comparisons can be made between the experiments.

Thus, whereas the addition of U + M to MS produced only a 9% increase in DM intake of the cows, and a 14% rise in FCM yield, the consumption of wethers fed the same forage was raised by 30%, and the ration was improved from one which merely supplied maintenance needs, to one supporting a daily weight gain exceeding 100 g per head. By contrast, compared with MS alone, supplying the milking cows with a mixed ration of 75 MS:25 Tama ryegrass without U + M, resulted in 15% and 27% increases in DM intake, and FCM production, respectively, and a substantially smaller reduction in MS consumption than when the wethers were fed a mixed ration of somewhat similar proportions (65 MS:35 Tama).

These differences are probably largely a reflection of the widely differing requirements of livestock for lactation as contrasted with growth, one measure of which is obtained by comparing the voluntary intakes of the wethers and cows fed solely on MS. Expressed as a percentage of liveweight, these are 1.4% and 2.2% for the sheep and cows, respectively.

Costs of ingredients for the supplementary mineral mixture were \$4.00 per tonne MS dry matter, and were similar for the added urea. Two-thirds of the cost of the mineral mixture was for the major elements and the remainder for the trace elements.

In the absence of the grass supplement, costs of the U + M supplement were exceeded by returns from additional milk, but at the higher levels of production achieved with grass as 25% of the ration, extra costs and returns were essentially similar. Although lowered costs could be achieved by reducing amounts of some of the supplements used, and possibly by using alternative, cheaper sources of some elements, these and other studies

(Bryant and Donnelly, 1974) indicate that it should prove more productive and profitable to raise substantially the proportion of grass in the total ration for lactating cows, than to persevere with a relatively small grass fraction, and a large proportion of MS fortified with N and other elements.

For growing-fattening sheep, the situation appears to be substantially different, since costs of the MS supplement are greatly exceeded by returns anticipated from the additional liveweight gains. These results, if confirmed with other classes of sheep and cattle, will have important implications for the provision of out-of-season feed for heavy-weight lamb production, for flushing ewes and for finishing beef cattle.

Pertinent to this, in a beef cattle trial still in progress at Ruakura, a marked response in liveweight gain has been obtained by supplementing maize silage with a similar mixture of urea and minerals (T. F. Reardon, pers. comm.).

#### REFERENCES

- Bryant, A. M.; Donnelly, P. E., 1974: *N.Z. JI agric. Res.*, 17: 299.  
Joyce, J. P., 1971: In *Research in the N.Z. Department of Agriculture, 1970-71*. Ministry of Agriculture and Fisheries, Wellington.