The Use of Oilseed Cake from Small-Scale Processing Operations for Inclusion in Rations for Peri-Urban Poultry and Small Ruminant Production (R7524)

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Abstract

The development of poultry feeds in rural areas has been constrained by lack of information on the feeding value of potential protein sources such as sunflower cake produced by the ram press. The ram-pressed cake is high in fibre, protein and fat, and is a valuable source of energy, lysine and methionine for poultry. Selective sieving of the cake can reduce the fibre level by approximately 28% and increase the protein level by 15%. I*n vitro* digestibility studies (gas production) indicate that the ram-pressed cake may be slowly degraded in the rumen.

Introduction

Small-scale pressing of oilseeds is well established, but information on the use of the oilcakes in small-scale livestock production is unavailable. The project will enable peri-urban and rural livestock producers to make the best utilisation of sunflower oilseed cakes in local feeds. The high level of fibre in oilcake is a constraint to its inclusion in poultry feeds. Simple technologies for separating the fibre fraction will be investigated and the performance of broiler feeds based on reduced-fibre oilcakes evaluated. Oilcakes are valuable sources of protein for small ruminants on nitrogen deficient diets. Little is known of the digestibility characteristics of ram-pressed sunflower cake and the effect which the relatively high fat levels may have on rumen function. The income generating potential of oilcake-based small-scale livestock production will be evaluated.

Project Progress

Developments have been made in four areas:

1. Socio-economic analysis of poultry and small ruminant production in Zimbabwe.

2. Improving the facilities for feeding trials with goats and poultry at Henderson Research Station.

3. Analytical data on feed raw materials for feeding trials.

4. Experimental studies in fibre removal from Ram-Pressed Sunflower Cake.

1. Socio-economic Analysis of Poultry and Small Ruminant Production in Zimbabwe

Studies were conducted in four poultry and small ruminant producing areas of Zimbabwe, two communal and two peri-urban (Hanyani-Mlambo, 2000). Peri-urban areas were Domboshava, which borders Harare, and Esigodini, which borders Bulawayo. Selected communal areas were Muzarabani and Chivi Districts. Surveys revealed that about 95% of peri-urban and communal families keep poultry, and the majority of indigenous poultry producers in communal areas are women. Indigenous poultry are reared under a scavenging system where inputs for housing, breding and feeding are minimal, and productivity is low. Hybrid birds are reared by the richer, more educated farmers. In typical communal areas, only 10% of farmers are involved in hybrid poultry production. Approximately 70% of hybrid producers reside in peri-urban areas and 30% in communal areas. Hybrid poultry production systems are run strictly on business lines, and may be broilers, layers or mixed systems. Flock sizes ranged from 25-1800 birds, with a mean of 159 birds. In contrast the mean indigenous flock was 21 birds with a range of 2-110. Occasionally indigenous birds are fed spoiled grain, oilseeds or household scraps. There was no evidence of the provision of compounded feed to indigenous birds to enhance their growth or egg laying performance. Most eggs are retained for regeneration of the flock.

Small ruminant production is based on a scavenging / browsing system, with minimal supplementary feed.

Chicken meat is preferred to goat meat, but some consumers prefer the tender meat from hybrid birds, rather than the more mature and tougher texture of indigenous birds. Indigenous birds may be more than five months of age before slaughter compared with a hybrid slaughtered at 7-10 weeks, at a live weight of approximately 2 kg.

Many producers considered that the rearing of both poultry and small ruminants was an insurance mechanism to provide food in times of drought, vagaries in the weather or other adverse factors within the local farming system.

2. *Improving the Facilities for Feeding Trials with Goats and Poultry at Henderson Research Station*

Henderson Research Station has a good infrastructure for conducting controlled animal feeding trials. However, although the buildings are sound they required upgrading to enable measurements of the individual feeding characteristics of goats and the group feeding of poultry to be conducted. Project funds were dispersed for this upgrading, and revisions to pens are near completion. Since poultry studies will include the comparative performance of commercial broilers and indigenous birds a small egg hatcher has been purchased to enable eggs collected from rural areas to be hatched under controlled conditions.

Six hundred kg of sunflower seed of a local variety, 'Pannar' (a high oil hybrid), have been ram-pressed at Henderson in readiness for the preparation of feeds.

Efficiency of oil extraction from sunflower seed:
The efficiency of oil extraction from the ram press is a function of human effort, appropriate setting up of the press, the temperature of the seed and its varietal characteristics. For the experimental material: 100 kg seed of 43.2% oil content yielded 85 kg cake of 33% oil content and 15 kg of sunflower oil.

3. *Analytical Data on Feed Raw Materials for Feeding Trials*

Samples of ram-pressed cake and prospective feed materials for poultry and goat feeding trials have been analysed for chemical composition, and where appropriate for *in–vitro* digestibility by the gas production method. (Tables 1,2 and 3)

Raw materials for use in poultry diets will include sunflower cake, soyabean meal, maize, minerals and vitamins. It is expected that 75-80% of the raw materials for poultry production can be sourced from a peri-urban or rural farm. For goat trials, all raw materials can be sourced from rural or peri-urban areas. These are sunflower cake, sunflower heads, maize stover and groundnut tops, together with access to vegetation for browsing.

The amino acid analyses of sunflower ram-pressed cake obtained from village sources is similar to that of seed pressed at Henderson, and confirms the relatively low levels of lysine and methionine in this raw material (0.7% and 0.4% respectively). Supplementation of sunflower with additional sources of protein, such as soya bean meal, which are high in lysine, methionine and cystine, will be necessary to obtain reasonable growth performance of poultry.

I*n vitro* digestibility studies imply that, relative to sunflower heads, groundnut tops and maize stover, sunflower ram-pressed cake will not be rapidly degraded in the rumen. This may be a function of the high fat content in the cake giving a degree of protection against microbial degradation. Feeding trials will indicate the levels of fat in the sunflower cake which may depress rumen function.

4. *Experimental Studies in Fibre Removal from Ram-pressed Sunflower Cake*

Fibre levels of 20% in sunflower cake are potentially limiting the inclusion of this material in poultry diets where the target fibre level in the final feed is approximately 6%. Any reduction in fibre will cause a corresponding increase in protein and oil, which may assist in increasing the inclusion level of sunflower cake in the diet. Trials have been conducted at NRI and Henderson to determine whether sieving can remove fibre from sunflower cake to any significant level.

The results of the trials are presented in Table 4 and may be summarised as follows: screening through a 1mm screen can reduce the fibre level in sunflower cake by 40%, but the yield of this material is low when compared to the amount of energy and time used to produce it. Sieving through a 1.4 mm screen produces a fine product with a 28% fibre reduction and 15% increase in protein. The fraction passing through the sieve represents 30% of the original material and is a feasible product to produce.

While the fraction passing through a 2 mm screen appears to give a similar product to that obtained by a 1.4 mm screen, there was a greater sensitivity needed on the part of the operator not to force as much as possible through the screen. A 1.4 mm screen will more likely be a promising compromise. The fine, lower fibre and higher protein material passing through the sieve can be used for poultry feed. The coarser retained fraction can be used for goats.

Proposed Feeding Trials

Poultry:

Phase 1

- Hybrids vs Indigenous stock using commercial starter and finisher feeds

  Start date: December 2000

Phase 2

- Increasing levels of sunflower as ram-pressed sunflower cake (RPSFC) in balanced feed for finishers, but using a commercial starter
- Increasing levels of RPSFC in balanced feeds for starter and finisher

Goats:

- Stall-fed complete diets based on RPSFC, maize stover, sunflower heads, groundnut tops, minerals.
- Stall-fed + browse + RPSFC
- Browse +RPSFC
- Browse only

Table 1: Nutritional value (of feed raw materials)

a) For poultry feeding trials:

Raw material	Oil	Csrude Protein	Crude Fibre	Lysine (%)	Meth. + cys.(%)	Ca (%)	P (%) (MJ/kg)	ME
RPSFC[12]	32.6	20.3	20.2	0.7	0.8	0.2	1.0	12.3
Maize	4.0	9.0	3.0	0.3	0.4	—	0.3	14.2
Soya bean meal	1.0	44.5	5.5	3.0	1.4	0.3	0.6	9.4
Fishmeal	4.0	65.0	—	5.0	2.5	6.2	3.0	11.5

b) For goat feeding trials:

Raw material	Oil (%)	Crude Protein (%)	Crude Fibre (%)	Ash (%)	ME (MJ/kg)
RPSFC[1]	32.6	20.3	20.2	4.3	11.1[3]
Sunflower heads	14.7	13.4	31.6	6.1	7.4
Groundnut tops	2.1	12.6	34.3	15.2	7.6
Maize stover	1.2	4.0	39.9	6.2	7.1

[1]RPSFC = *ram-pressed sunflower cake*

[2]*Potential limitations in* RPSFC: *high fibre and high fat*

[3] *estimated at* 90% *of poultry* ME

Table 2: In-vitro digestibility of feed raw materials for goat feeding trial
(Rate of gas production with time)

Feed material	Peak gas production rate (ml/hour)	Time at peak gas production (hours)
Maize stover	6.0	14
Groundnut tops	8.5	12
Sunflower heads	12.5	14
RPSFC[1]	4.5	5

[1] RPSFC = *ram-pressed sunflower cake*

Table 3: Amino acid composition of ram-pressed sunflower cake (RPSFC)
(g/100g dry matter)

	Village produced RPSFC	Henderson produced RPSFC
Taurine	0.03	0.03
Hydroxyproline	0.07	0.07
Aspartic acid	1.74	1.68
Threonine	0.74	0.69
Serine	0.78	0.71
Glutamic acid	3.52	3.44
Proline	0.84	0.79
Glycine	1.31	1.06
Alanine	0.87	0.82
Cysteine	0.41	0.34
Valine	1.03	0.97
Methionine	0.45	0.41
Isoleucine	0.84	0.78
Leucine	1.29	1.19
Tyrosine	0.47	0.40
Phenylalanine	0.90	0.86
Hydroxylysine	0.01	0.02
Histidine	0.53	0.46
Ornithine	0.02	0.02
Lysine	0.77	0.67
Arginine	1.62	1.57
Tryptophan	0.26	0.23

Table 4: Removing limitations for ram-pressed sunflower cake* (RPSFC): *effectiveness of fibre separation from* RPSFC *by sieving

Screen size		Fibre	Oil	Protein	%
RPSFC		20.2	32.6	20.3	100
1.0 mm	Retained	22.8	29.4	15.7	88
	Through	11.7	35.0	26.9	12
1.4 mm[1]	Retained	22.9	29.6	18.6	70
	Through	14.5	32.2	23.1	30
2.0 mm	Retained	25.4	29.8	14.1	76
	Through	15.0	33.4	23.1	24

[1]*At 1.4 mm:* 28% *reduction in fibre,*
15% *increase in protein*

Reference

HANYANI-MLAMBO, B.T. (2000). Demand for livestock fed and benefits for the poor: A Zimbabwean case study. P*roject Report March* 2000. Natural Resources Institute, Chatham, Kent, UK. pp 17.

Questions and Answers

Could poultry avoid hulls? If so, intake of the feed would be different to the gross amount analysed

Separating the kernels from hulls would not be very practical but the project could attempt it. The project was also going to introduce fishmeal into its control. It would take 5-10 minutes to sieve 1kg of sunflower cake in order to reduce fibre content.

As the mortality of chickens was very high (approximately 60%), was sunflower cake being suggested as a supplement? Did that mean the main cause of death was lack of nutritious feed?

There were lots of reasons for the high death rate (e.g. Newcastle disease). The requirements for additional feed came from the women involved in the project. It could be that as well as more than 20% of feed coming from a local source, some of the women realise that they are currently buying concentrate that includes substances they already have access to, suggesting there is no need to buy the concentrate.

Did the project team think that smallstock (poultry and goats) keepers have the required knowledge and skills in feed rationing to utilise the range of feed supplements the project was proposing during the course of the year?

A lot of the women involved have sufficient knowledge. From the project's point of view, the Project Leader would like to give a supply of feed to be used at different times throughout the year. No major changes occur in the oil, e.g. aflotoxins, so this can be used over a period of time.

Would indigenous chickens also be used in the study?

The commercial chickens were being used as part of the control. One of the advantages of indigenous chickens over commercial ones is that they are able to eat more fibre. The project is getting different messages from the participants: some of the women want indigenous chickens and some want commercial ones. It might turn out that it is better for the women to focus on the hybrid chickens and let the indigenous ones scavenge. It was explained that the project did not know how many different breds of chickens there were or what their respective productivity was but the University of Zimbabwe was looking into this. Work is also taking place at Henderson Research Station on indigenous chickens.

Some years back work was carried out on indigenous chicks reared under communal conditions. The information was never published. In the early 1980s someone tried to write a paper and published it. Unfortunately they only monitored indigenous chickens and did not have any control chickens so it was difficult to get the paper published.

A representative from one of the NGOs explained that the NGOs and farmers had noticed a reduction in the number of chickens in homes. The NGOs are trying to assist communal farmers in re-introducing chickens into their homes, but do not know if they are doing it the right way or not.

What sort of chickens would the peri-urban farmers would be using?

A survey had not yet been carried out on the peri-urban farmers, but the project team thinks that the information generated so far will also be of interest to them. It is likely that commercial birds will be used.

Many smallstock farmers were not aware of the benefits of sunflower oil and, therefore, do not grow it. The cost of milling will be estimated. There were women who offer their mill as a service. Some of the women do not know what to do with the cake. There is no way of putting a value on the cake.

Were there management systems to accompany the different breds of chicken, i.e. indicating the type of feed they should be eating?

As most of the chickens used were scavenging ones this information was not available. The chickens have different requirements depending on their age and there is a lot of competition between the groups. If a management system could be set up so that the young chicks were kept separate from the rest they might have more chance of survival.