Utilization of Sunflower Crop Residues as Feed in Small Ruminants

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ABSTRACT : Sheep and goats in Pakistan have not been able to produce to the best of their potential. This may primarily be attributed to under feeding and malnutrition. Ranges have been depleted due to overgrazing and mismanagement and are not in position to feed the existing small ruminant population. To overcome the shortage of good quality fodder and balanced feed supply, the alternate means like cereal straws and other crop residues are being commonly used. Sunflower crop residues like stalks and heads provide a good quality forage for livestock. These crop byproducts are rich in crude protein and lower in crude fibre. Their inclusion in the diet of small ruminants at 20, 30 and 40 percent levels in ration has shown significantly ($p < 0.05$) increased feed intake and weight gain.

Daily feed intake was 1,130, 1,180 and 1,750 g for sunflower crop residue, soybean crop residue and wheat straw, respectively, when added at the rate of 20 percent in the ration. The drymatter digestibility of sunflower, soybean crop residues and wheat straw was also comparable. The maximum performance of the animals was observed at the 20 percent level of inclusion of sunflower crop residue in the diet.

(**Key Words**: Sunflower, Soybean, Crop Residue, Small Ruminants)

INTRODUCTION

Goats and sheep are integral part of livestock industry in Pakistan. According to recent estimates, the population of these animals is more than 72 million heads (GOP, 1994). These animals contribute a reasonable amount in the economy of the country by producing meat, milk and skin. In addition, these animals also provide a source of income for millions of landless families in remote regions of the country. Despite a large population, production per animal is low. Out of many reasons, underfeeding and malnutrition is considered to be of prime importance. Large ruminants i. e cattle and buffaloes are given priority and these small ruminants carry secondary importance.

Available feed resources in Pakistan comprise of green fodder and conventional agroindustry byproducts like oilcakes, wheat bran etc (Sial et al., 1988). Green fodder is usually grown for large ruminants and small ruminants have to rely on grazing the road sides, canal banks and stubbles. To overcome the shortage of good quality roughages for livestock specially the small ruminants, alternate means like straws of cereals and other crop residues are becoming popular among the farmers as a source of feed. Total requirements of our animals is estimated to be about 61.29 m.t for total digestible nutrients and 11.29 m.t. for digestible protein (Khan et al., 1994). Crop residues contribute the major share about 47 percent and the fodder crops contribute 25.3 percent. Rangelands, pasture grazing and herbs etc provide only 17 percent. The rest comes from cereal grains, supplements and other agro-industry byproducts. Out of the available feed resources, crop residues contribute more than 50 percent of the feed supply. The total quantity of crop residues has been estimated to about 48.33 m.t (GOP, 1985). These crop residues largely comprise of wheat and rice straws as well as stalks of maize, sorghum and millet etc.

Like the creeal straws, oilseed crop residues are also available in limited quantities for livestock feeding. A range of oilseed crops are currently being produced in Pakistan to yield primarily the oil industry by products like meal, cakes and residues of these crops, serve as secondary purpose. Table 1 gives the quantity of some of the oilseed crops pruduced in the country.

A considerable work has been on the use of industry byproducts of oilseed crops in livestock and popultry feeding and its importance cannot been denied. Very litter

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work has been done on the utilizaition of residues of these crops as feed in livestock particulary the ruminants.

Table 1. Oil seed crop production in Pakistan during 1995

Crop	Production (m.t)
Cotton	2,961.0
Mustard/Rape	207.0
Groundnut	105.7
Sunflower	102.0
Sesame	36.2
Castor	1.6
Linseed	3.9
Soybean	6.5
Safflower	0.8

Sunflower crop residues

Among the oilbearing crops, sunflower is a non-conventional one, which has been grown in the increasing amounts during the recent past. Sunflower is one of the highest producer of energy and protein and many feeds of high nutritive value are derived from its byproducts (Stoyanov, 1988). About 57 percent of the total energy of it, is in the form of crop by-products useful in animal feeding (PARC, 1993). In the form of origin, sunflower crop yields usefull forage, primarily in the form of stalks and subsequently the heads, after separation of the seeds. Following the harvest, both to these byproducts can make a significant contribution to the basal ration of ruminant livestock. Sunflower heads and stalks have a considerable economic importance and both the products provide a valuable fodder. Their nutritive value appears to be improved by harvesting and storing and feeding the two products mixed together.

Sunflower heads are rich in crude protein and lower in crude fibre than the stalks. For animal feeding the heads and stalks may be supplemented with non-protein nitrogen. Sunflower heads can be stored for four to five years without deterioration when kept in dried form. In experiments with fattening steers, sunflower heads, hay and stems satisfactorily replaced hay and straw or maize silage. But sunflower forage is lower in carotene content (PARC, 1993). Table 2 gives a comparison of nutritive value of sunflower heads and stalks with wheat, rice and rape straws.

Sunflower stover has only a low crude protein content, comparable to those of wheat and rice straws. The crude fibre content of the stalk is much lower than that of wheat straw and is expected to be of higher digestiblity. Its fibre level is similar to rice straw but sunflower is lower in silica. Reddy (1992), reported 43.85 and 2.15 percent TDN and DP values, respectively for sunflower straw. Eroarome and Aregheore (1992) found better liveweight gains and feed efficiency rates in goats fed sunflower based rations. Reddy et al., (1992) observed that digestibility of all nutrients including cell wall constituents and nutritive value of sunflower straw was comparable.

Based on the findings of the international reports on the utilization of oilseed crop residues in the feeding of livestock particularly the small ruminants, study was planned to determine the response of sheep and goats to the inclusion of SFCR at various rates of inclusion in the ration.

Table 2. Composition of sunflower heads and stalks in comparison to wheat, rice and rape straw

Particulars	Composition (%)				
	Sunflower Stalk	Sunflower Heads	Wheat Straw	Rice Straw	Rape Straw
Organic matter	88.0	89.4	91.0	85.0	91.2
Crude protein	2.8	7.2	3.0	2.6	6.2
Crude fibre	31.0	16.0	40.0	30.0	44.1
Ether extract	2.0	2.9	0.9	0.9	1.9
Total ash	12.0	10.6	15.0	15.0	8.8

MATERIALS AND METHODS

Sunflower and soybean crop residues (heads and stalks) were collected from the fields of National Agricultural Research Centre after harvesting the seeds. The fresh residues were spread in the sunlight for drying purpose. After the residue were completely dried, they were stored at room temperature for further use. Rations based on sunflower and soybean crop residues were formulated at varying rates of inclusion in two different

experiments (table 3). Other ingredients were cottonseed cake, rice polishing, wheat bran, maize grain, molasses cane, dicalcium phosphate, and sodium chloride. The representative samples of the rations were saved for proximate analysis for dry matter, nitrogen, crude fibre and total ash by (AOAC, 1985). The studies were conducted as Small Ruminant Research Station of National Agricultural Research Centre, Islamabad.

Thirty six (36) and twenty four (24) yearling sheep and goats were used in the study I and II, respectively. These animals were selected and grouped randomly on the basis of their body weight according to completely randomized block design. The animals were put in the feeding pens. The rations were offered at 08:00 hours in the morning and refusals recorded to calculate daily feed intake. Fresh water was available to the animals in the pens.

Table 3. Drymatter, crude protein, crude fibre and total ash composition of three rations used in two experiments

Rations	Percent composition (%)			
	DM	Crude protein	Crude fibre	Total ash
Experiment I				
R1 (SFCR* 20%)	86.62	15.47	16.72	12.70
R2 (SBCR** 20%)	86.80	14.39	16.84	10.64
R3 (Wheat straw 20%)	87.04	11.13	16.90	9.84
Experiment II				
R1 (SFCR 20%)	88.40	15.75	18.50	14.40
R2 (SFCR 30%)	88.10	12.25	23.50	12.60
R3 (SFCR 40%)	88.00	10.50	31.00	13.00

* Sunflower crop residue, ** Soybean crop residue.

The animals were weighed on weekly basis for any change (gain/loss) in the body weight by using a digital weighing balance. The animals were keenly observed by a veterinarian for general health and for any other dysfunction. At the end, a digestibility trial was also conducted to assess the drymatter digestibility of sunflower and soybean based rations. The animals were put in the metabolism crates for the determination of digestibility. Feces voided were collected before feeding in the morning, weighed and ten percent representative samples saved for further analysis.

The data on feed intake, liveweight changes and digestibility were tabulated and analysis of variance technique was used to test the significance of variables by using dbase software SAS programme.

RESULTS AND DISCUSSION

Experiment I

The data on feed intake and weight gain is presented in table 4. Treatments showed highly significant ($p < 0.01$) effect on the daily feed intakes of the animals. The animals consumed maximum of wheat straw based ration (1,750 g) as compared to sunflower (1,130 g) and soybean (1,180 g) crop residue based rations. Average daily weight gain was however found to be maximum in

Table 4. Results of feed intake, weight gain, digestibility and feed conversion ratio in experiment 1

Particulars	R1	R2	R3
Average daily feed intake (g/head/day)	$1,130^{b} \pm 76.1$	$1,180^{b} \pm 76.1$	$1,750^{a} \pm 76.1$
Average daily weight gain (g/head/day)	$175^{a} \pm 10.8$	$154^{b} \pm 12.0$	$145^{b} \pm 13.5$
Drymatter digestibility (%)	59.29 ± 1.00	60.14 ± 0.81	58.47 ± 1.27
Feed conversion ratio	6.45	7.66	12.06

^{a,b} Mean values with different superscripts in the same row differ significantly ($p < 0.01$).

the animals fed SFCR (175 g). It was significantly higher than the animals fed SBCR (154 g) and wheat straw (145 g). This is supported by the findings of Eroarome and Aregheore (1992). Esterhuyre et al. (1991) has reported that sheep gained weight when grazed sunflower, soybean and other crop residues.

They reported that sheep on soybean residues gained average daily gain of only 47 gm. Gowd et al. (1987) however, have reported that daily feed intake (336.1) was not affected by diet containing sunflower head and meals.

Daily feed intake by the two species showed significantly ($p < 0.01$) higher feed intake for sheep (115.0 g) than goats (85.0 g). It means that sheep consumed about 79 percent more feed than goats. Alhassan et al. (1986) has reported a higher intake of straw in sheep than goats. Feed intake was however non-significant for sex. Whereas weight gain was significantly ($p < 0.01$) higher for both species and sex. Feed efficiency was however found to be better for SFCR and SBCR as compared to wheat straw based ration. It means that the animals consumed 6.45 and 7.66 g of SFCR and SBCR based ration for one g of gain in body weight as compared to wheat straw (12.1 g).

The dry matter digestibility was found to be non significant among the treatments (Reddy et al., 1992). Gowd et al. (1987) found higher digestibility of drymatter and crude fibre than the conventional diets. Cheva and Saeugdee (1987) have reported 58.2 percent dry matter digestibility of soybean pod husks. Bento et al. (1986) found 46.98 and 38.24 percent dry matter and crude fibre digestibilities. Drackley et al. (1985) observed 40.6 and 31.4 percent DM and cell wall *in vitro* digestibilities in heifers. He reported that digestbilities were decreased with increased sunflower crop residue in the ration. He concluded that with proper supplementation, sunflower was an acceptable roughage upto 32 percent of total ration.

Experiment II

In the second experiment sunflower crop residue was included at the rate of 20, 30 and 40 percent in thd diet. The average values of the daily feed intake, weight gain and feed efficiency is given in the table 5.

Table 5. Daily feed intake, weight gain and feed conversion ratio of animals fed varying levels of sunflower crop residue in the diet

Particulars	R1	R2	R3
Average daily feed intake (g/head/day)	1,410 ± 121	1,356 ± 121	1,330 ± 121
Average daily weight gain (g/head/day)	94.6 ± 15.0	92.5 ± 12.0	81.8 ± 15.0
Feed conversion ratio	12.06	14.65	16.26

A non-significant effect was observed in daily feed intake due to 20, 30 and 40 percent levels of sunflower crop residue inclusion in the diet. The mean values for feed intake were 1,410, 1,356 and 1,330 g, respectively. Generally, the increase in the level of SFCR in the ration caused a decrease in the feed intake. Average weight gain by the animals were 94.6, 92.5 and 81.8 g for 20, 30 and 40 percent inclusion rate of sunflower crop residue. It was also observed that feed intake was significantly higher in sheep as compared to goats. The data indicates that mean values for feed intakes were 90.13 and 43.68 kg for sheep and goat, respectively. Average daily intake values were 184 and 89 g for sheep and goat, respectively. Feed efficiency was found to better with 20 percent SFCR ration and it was least at 40 precent rate of inclusion in the diet.

Based on the findings of the two studies, it is concluded that sunflower crop residue is a good source of feed as a basal ration and can be added in the ration upto 20 percent level.

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