

## Ethical use of cereal legume intercrop forages for feeding of sheep and pasture development

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### Introduction

Cereal forages are important in the feeding of livestock for their high energy and dry matter content. However, they are low in protein content and inferior in other nutritional quality than the legume forages. Ruminants required protein as well as energy to maintain their production. Supplementation of protein through concentrates is cost effective in livestock production. Besides, ruminant is unique in having the potential for cycling forage materials, poor quality protein and non protein nitrogen sources into human food supply as meat and milk (Eskandary *et al.*, 2009). Thus, management of forages for livestock feeding either in feedlot or in pasture grazing is the key task of livestock manager to minimize cost in maximization of profit. In agricultural system, intercropping is a crop management system involving two or more crop species grown together for at least part of their productive cycle (Innis, 1997). Cereal legume intercropping system is more productive and profitable cropping system for the supply of balanced nutrients to livestock. Besides, animal welfare committee pointed out that there should not be restriction or prevention of natural innate behaviour including natural foraging or exploratory behaviour of animal. As per this, animals foraging behaviour on feeding and thereby analysis of the system and its application in livestock farming and pasture development as per species of animal became utmost important in forthcoming days of livestock farming. Intercropping of cereals and legumes can boost forage protein of animal's diet which may be tested for animals choice in foraging will justify the ethics in animal feeding.

### Materials and Methods

Intercropping of forages for the feeding of sheep done using Cereal Maize (*Zea mays*) cv. Ganga and legume Cowpea (*Vigna unguiculata*) cv. BL-1 were used as monsoon forage and cereal Oat (*Avena sativa*) cv. JHO-822 with legume Berseem (*Trifolium alexandrinum*) cv. Wardan as winter forage were introduced in intercropping for foraging by Jalauni sheep at semi arid tropical climate of Jhansi in central India. Jhansi situated at 25.4333N 78.5833E with average elevation of 284 meters and experiences extreme climate and mercury goes at 4 degree Celsius minimum in winter and summer temperature can peak at 47 degree Celsius in May. Standard agronomical practices followed in intercropping with plant to plant distance maintained 25 cm in both the cropping. Line spacing also was at 25 cm distance and intercrop combination was 2:1, 1:2 and 1:1 for cereal and legumes which were compared with sole cereal and legume. For foraging, intercropped forage was harvested at 60 days of growth and 24 sheep were allowed to eat chaffed forage with open access of all the intercropped forage mix in close vicinity without making any external stress of competition from other animal. Their feeding time recorded consecutively for 6 days in each season. The green yield (GFY), dry matter yields (DMY) and crude protein yield (CPU) was analyzed in respective feeding at 60 days of harvesting stage in each intercropping. Recorded data analyzed statistically following general linear Model of SPSS package.

### Results and Discussion

Cereal legume intercropping found more productive at their 60 days of growth and harvested forage was offered to experimental animals. Green fodder yield found maximum  $82.85 \pm 1.47$  t/ha with  $11.95 \pm 0.42$  t/ha dry matter and  $1.82 \pm 0.03$  t/ha crude protein. Green forage yield in maize intercropped with cowpea did not varied but dry matter and protein varied with significantly more protein in 2:1 line ratio of maize and cowpea. The same trend of yield was also recorded earlier (Sahu, 2006; Filho, 2000). Intercropping of oat with berseem had significantly more biomass production in 1:2 combinations with more dry matter and protein yield. Protein harvested significantly more when combined with oat rather than sole oat or berseem. Thus intercropping with legume had significant effect in green, dry matter as well as protein yield. Maize and cowpea intercropped yielded more in 2:1 ratio but berseem and oat intercropping yielded more in 1:2 ratio.

**Table1: Yield (t/ha) of cereal legume intercrop at 60 days of growth**

Monsoon intercrop- Maize with Cowpea				Winter intercrop Oat with Berseem			
Crop combinations	GFY	DMY	CPY	Crop combinations	GFY	DMY	CPY
Maize+Cowpea 2:1	82.85± 1.47	11.95 <sup>c</sup> ± 0.42	1.82 <sup>b</sup> ± 0.03	Oat+ Berseem 2:1	34.43 <sup>a</sup> ± 3.22	3.48 <sup>a</sup> ± 0.32	0.86 <sup>bc</sup> ± 0.08
Maize+Cowpea 1:2	78.52± 2.96	11.29 <sup>c</sup> ± 0.85	1.13 <sup>a</sup> ± 0.04	Oat+Berseem 1:2	54.16 <sup>c</sup> ± 4.17	5.80 <sup>b</sup> ± 0.44	1.16 <sup>a</sup> ± 0.09
Maize+Cowpea 1:1	73.05± 3.59	11.37 <sup>c</sup> ± 1.10	1.38 <sup>a</sup> ± 0.06	Oat+Berseem 1:1	28.20 <sup>a</sup> ± 6.10	2.93 <sup>a</sup> ± 0.63	0.59 <sup>d</sup> ± 0.12
Maize	66.72± 3.94	17.21 <sup>b</sup> ± 2.03	1.26 <sup>a</sup> ± 0.14	Oat	51.00 <sup>bc</sup> ± 2.81	5.75 <sup>b</sup> ± 0.31	0.80 <sup>cd</sup> ± 0.04
Cowpea	74.95± 3.74	8.61 <sup>a</sup> ± 1.11	1.36 <sup>a</sup> ± 0.17	Berseem	40.00 <sup>ab</sup> ± 2.26	3.82 <sup>a</sup> ± 0.11	1.06 <sup>ab</sup> ± 0.03
F Value	1.363	17.51	7.79	F Value	8.07	10.78	7.44

Values with different superscript varied significantly (P>0.05)

When Jalauni sheep were allowed to forage on chaffed mix intercrop forage, they preferred cereals most with better palatability and among the intercrop mix they preferred mix maize with cowpea in 2:1 ratio intercropping. During winter, sheep preferred oat most but among the intercrop they spent more time on berseem and oat intercrop in 1:2 ratio, followed by 2:1 ratio. Thus, sheep preferred cereal most but intercrop of maize and cowpea in 2:1 in monsoon and 1:2 in berseem and oat intercrop was preferred. The extent of animal tendency to eat the forage and may influence by texture, leafiness, moisture content or compounds that cause forage to taste sweet, sour or salty (Ghanbari-Bonjar and Lee, 2003).

### Conclusions

Cereal legume intercropping with maize and cowpea in monsoon and Oat with berseem in winter had better green yield (t/ha) at 60 days of harvesting with significantly more DM yield i.e, 11.95±0.42 t/ha and protein yield of 1.82±0.03 t/ha in monsoon and oat with berseem in 1:2 ratio in winter yielded 1.16±0.09 t/ha protein. Jalauni sheep preferred cereal most followed by maize with cowpea and oat with berseem in 2:1 ratio. Thus, ethical use of those intercrop mix found palatable for sheep and development of legume based pasture may improved with introduction of cereals for better total biomass as well as dry matter and available crude protein yield. Near future will be for preferential feeding for animal with intercrop foraging protecting animal welfare.

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