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CEREAL STRAWS IN THE FEEDING SYSTEM OF RUMINANTS IN SENEGAL

By

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INTRODUCTION

A moving back of drought has been recorded in African sahelian countries during the two pas-t years. Thus, pastures are in better condition, however the availabie biomass remains insufficient. Alimentation is still the major constraint to the improvement of livestock productivity in Senega .

The challenge for research workers Iivestock technicians and fat-mers is to imagine a highly efficient feeding system using the available feed ressources in'each region of Senegal.

Within the framework of agriculture and livestock association, low quality crop residues emerge as one of feed ressources wich would play an important role in the attempt of meeting dry matter and emergy requirements of ruminants in senegalese agricuitural.

In 1986, 887 820 tons of maize, millet, sorghun and rice grain have bean harvested. The estimated straw out put is 4 800 000 tons (FALL et al. 1987). This aval lable quantity is expected to Increase soon with the development of irrigation in senegal river valley. The main areas of production are the groundnut basin, senegal river valley, Tambacounda and Casamance.

Prevlous studfes carried ou-t in LNERV have emphasized the low concentration In digestible nutrient bulkiness and low Ingestibility of cereal straws (CALVET et al. 1973, CALVET et Al. 1974, SALL, 1985, FALL et Al. 19871.

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TABLE 1 : CEREAL STRAW SUPPLEMENTATION

RATIONS	SPECIES	NUMBER OF TRIALS	LEVEL BF CONCENTRATE p. 100
Rice straw + Cotton seed	Sheep	7	26
Rice straw + Peanutt cake	"	7	10
" "	Cattle	2	6,5
" "	"	8	10
" "	"	3	15
Rice straw + Rice poiishing	"	12	22
" "	Sheep	2	45
Rice straw + Rice break	"	6	28,5
Rice straw + molasse + urea	"	2	21,5
Rice straw + P*	Cattle	6	20

P* = mixture w/w of rice polishing and maize bran

TABLE 2 : CHEMICAL VALUE OF AGRO INDUSTRIAL BY PRODUCTS USED AS SUPPLEMENT

AGRO-INDUSTRIAL BY PRODUCT / CHEMICAL ANALYSIS g/kg DM	Cotton seed*	Peanutt cake N = 13	Mixture w/w Rice poiishing + Maize bran N° = 1	Rice polishing N = 14	Rice break N = 6
Ash	41	52 ± 5	103	63 ± 3	153 ± 7
Protein	193	504 ± 50	135	119 ± 53	81 ± 0
Crude fiber	250	28 ± 9	78	65 ± 30	70 ± 1
Ether extract	184	7 ± 0	76	44 ± 32	16 ± 0
Nitrogen free extract	256	408 ± 24	608	568 ± 242	683 ± 10
Calcium	1,5	1,2	1,1	0,8 ± 1.2	1,2
Phosphorus	5,1	6,2	9,5	10,7 ± 0,0	

* mean value indicated by MONGODIN et TACHER 1979

Offered alone, cereal straws cannot meet the maintenance requirement of cattle, sheep or goat. They need to be associated with concentrates in order to support intensive or semi intensive milk or meat production. Chemical treatment can also improve ingestibility and digestibility of low quality roughages.

Supplementation and alkali treatment of cereal straw have been carricd out in LNERV and IEMVT. The objectives of this paper is to describe experimental procedures, discuss availablc results in order i-o set up a best way of into gratlng cereal straws in the senegalese feeding system of ruminant.

EXPERIMENTAL PROCEDURES

Supplementation of rice straw

The main objectives of rice straw supplementa-tion was to improve rumen environnement and increase straw digestibility. Rations were intended to allow either maintenance or milk or meat semi intensive or intensive production. Thus rice straw has been associated to agro-industrial by products described in table 2. Composition of rations species and number of trials are specified in table 1.

Alkali treatment of cereal straws

NaOH and urea treatments of cereal straw have been comparatively carried out.
To avoid unjustifiable excessive loss of water a semi humid method (JACKSON 1979) has been applied.

Different levels of urea (3,5 and 6 p. 100) and sodium hydroxide (3, 4, 5 and 6 p. 100) have been tested.

The effect of urea treatment in dfffercnt species of cereal straw, millet, sorghun, maize and rice, has been reviewed,

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Evaluation of rations nutritive value

The nutritive value of supplemented rice straw, and alkali treated cereal straws has been evaluated by chemical analysis and in vivo digestibi lity -i-riais.

Chemical analysis Involved, organic ma-t-ter, crude fiber, crude protein, NDF, ADF, lignin, silica and minerals.

In vivo digestibilitles have been carried ou-t with a lot of six cattle or sheep. This experiment was brcken down into tow phases. 15 days of adjustment and 6 of measurment.

TABLE 3 : SUPPLEMENTED RICE STRAW : CHEMICAL VALUE AND DIGESTIBILITY OF RATIONS

RATIONS / ANALYSIS	Rice straw		Rice straw + cotton seed	Rice straw + Peanutt cake 500 g/day	Rico straw + Peanutt cake 1 kg/day	Rice straw + Peanut cake 250 g/day
	CATTLE	SHEEP	SHEEP	CATTLE	CATTLE	CATLLE
Organic matter	827 ± 19 N = 29	- -	824 ± 25 N = 7	833 ± 9 N = 8	836 ± 1 N = 3	840 N = 2
Crude protein	25 ± 13 N = 29	-	89 ± 12 N = 7	67 ± 8 N = 8	105 ± 1 N = 3	49 N = 2
Crude fiber	360 ± 34 N = 29	-	335 ± 24 N = 7	334 ± 10 N - 8	320 ± 6 N = 3	325 N = 2
Ether extract	14 ± 4 N = 29	-	53 ± 10 N = 7	11 ± 4 N = 8	13 ± 3 N = 3	10 N = 2
Free nitrogen exi-ract	428 ± 19 N = 29		381 ± 29 N = 7	422 ± 33 N = 8	397 ± 10 N = 3	456 N = 2
NDF*	555 N=1	-	503 ± 42 N = 6			
ADF*	428 N = 2	-	497 ± 46 N = 6			
Lignin*	62 N = 2	-	75 ± 10 N - 6			
Silica*						-
Calcium*	1.9 N = 2		2.4± 0.8 N = 7	1.8 ± 0.4 N = 8	1.6 ± 0.0 N = 3	2.3± 0.2 N = 2
Phosphorus*	0.7 N = 2		1.9± 0.6 N = 7	1.1 ± 0.1 N = 8	1.6 ± 0.0 N = 3	0.9± 0.0 N = 2
Magnesium *	-					-
Potassium*						-
Cobalt ppm			0.5 N = 1			-
Cuivre ppm			5.8 N = 1	-	-	-
Zinc ppm			43.1 N = 1			
Manganèse ppm			623 N = 1			
Iron ppm			1186 N = 1	-	-	-
Sodïum ppm				-	-	-
Dry mai-ter digestibility (p. 100)	56± 5 N = 15	49 ± 3 N = 15	50± 4 N = 7	54 ± 3 N = 8	57 N = 3	63 N = 2
Organic matter digestibility (p. 100)	64± 4 N = 15	58 ±4 N = 15	57-L 4 N = 7	63 ± 3 N = 8	64 N = 3	69 N = 2
Digestible organic matter intake	39± 7 N = 15	23± 4 N = 15	28± 2 N = 7	49 ± 6 N = 8	-	-
Digestible crude protein	3± 4 N = 15	0± 13 N = 15	45± 10 N = 7	35 ± 9 N = 8	76 M - 3	34 N = 3
Voluntary intake g/kg N, 75	74± 9 N = 15	48± 7 N = 15	60± 4 N = 7	95 ± 15 N = 8	100 N = 3	101 N = 2

* g/kg DM

TABLE 3 : SUPPLEMENTED RICE STRAW : CHEMICAL VALUE

AND DIGESTIBILITY OF RATIONS

RATIONS / ANALYSES	Rice straw + rice polishing		Rice straw + Peanutt cake 10 p 100	Rice straw + Rice polishing + maize bran	Rice straw + rice break	Urea greatec Rice straw + Urea	Urea greated Rice straw + Molasses + Urea
	CATTLE	SHEEP	SHEEP	CATTLE	SHEEP	SHEEP	SHEEP
Organic matter*	049 ± 19 N = 14		793 N - 2	841 ± 2 N - b	838 ± 5 N = 6	a03 N = 1	818 N - 2
Crude protein*	63 ± 11 N = 14		147 N = 2	52 ± 2 N-b	47 ± 2 N - 6	141 N = 1	73 N = 2'
Crude fiber	260 ± 35 N = 14		258 N = 2	255 ± 6 N = b	242 ± 8 N - b	369 N = 1	344 N = 2
Ether extract*	31 ± = 22 N 14		17 N = 2	29' 2 N = b	12 ± 0 N = 6	17 N = 1	10 N 2
Nitrogen free extract	495 ± 16 N = 14		371 N = 2	505 ± 4 N = 6	583 ± 3 N =b	356 N = 1	SOL N = 2
N D F*	413 N = 2		499 N - 2				
A D F*	229 N = 2		324 N = 2				
Lingnine*	46 N = 2		49 N - 2				
Silica*	100 ± 9 N = 6		15 N = 2		1.6 ± 0.1 N = 6	3.3 N =	2.1 N-2
Calcium*	2.0 ± 0.4 N = 14		3 N = 2	1.7' 0.1 N = b		0.5 N = 1	2.3 N = 2
Phosphore*	4.0' 1,7 N = b		2.5 N - 2	2.4 ± 0;4 N = 6			
Magnesium*	3.2 ± 0,6 N - b		2.2 N - 2				
Potassium*	11.7 ± 4.1 N = 6		14.9 N = 2				
Cobalt ppm*	0.6 N : 2		0.5 N = 2				
~~Cuivre~~ ppm	~~9.1~~ N = 2		~~7.5~~ N = 2				
~~Zinc~~ ppm	~~43.8~~ N = 2		~~47.3~~ N = 2				
Manganèse ppm	5880 N = 2		5600 N = 1				
Fer ppm	967 N = 2		1103 N = 1				
Sodium ppm	1938 N = 1						
Dry matter digestibility 100	59 ± 4 N - 13	47 N = 2	47 N = 2	75 ± 2 N =b	50 ± 4 N = 6	46 N = 1	50 N = 2
Organic matter digestibility (p 100)	74 ± 3 N 13	55 N = 2	57 N 2	79 ± 1 N = 6	58 ± 3 N = 6	56 N =	59 N = 2
Digestible organic matter intake*	64 ± 19 N 13			95 ± 15 N = 6	33 ± 4 N = 6		
Digestible crude protein	42 ± 7 N = 13	43 N - 2	107 N = 2	33 ± 1 N = 6	10 ± 3 N = 6	106 N = 1	32 N = 2
g/kg $P^{0,75}$ intake	102 ± 22 N = 13	65 N = 2	52 N = 2	137 ± 21 N 6	69 ± 5 N 6	40 N = 1	41 N = 2

* g/kg DM

[redacted] [redacted]

TABLE 4 : DIGESTIBILITY OF RICE STRAW IN COMPOSED DIETS COMPARED TO RICE STRAW OFFERED ALONE

RATIONS		SPECIES	ORGANIC MATTER DIGESTIBILITY p 100
Rice straw	N =15	Cattle	64 ± 4
Rice straw	N =15	Sheep	58 ± 4
" + Peanutt cake 500 g/day	N = 8	Ce-t-t-le	59.6± 2.7
" " 1 kg/day	N= 3	"	59.3± 2.0
" " 250 g/day	N = 2	"	68.4± 0.6
" + Rice polishing + maize bran	N = 6	"	80.9± 1.5
" + Rice polishing	N =12	"	73.8± 4.4
" + Rice break	N = 6	Sheep	37.1± 5.7

RESULTS AND DISCUSSIONS

I - RI CE STRAW SUPPLEMENTAI ION

1.1 - Peanutt cake

Peanutt cake is avai lable in the whole groundnut basin and in the south of Senegal .

Rations based on rice straw plus peanutt cake have been wel l consumed (see table 3).

To improve digestibi lity of straw, the levei of peannutt cake should be restricted. Previous studies (CALVET et Al. 1980, MBAYE et Al. 1983) have shown the depressive effect of peanutt cake on organic matter digesti bi lity (OMD) of straw when used in a too high percentage. Table 4 shows a significant ($P \leq 0,05$) depression of rice straw OMD at the level of 500 peanutt cake per day (10 per cent). Cuviously the improvement of rice straw OMD has not been significant at the level of 250 g of peanutt cake per day. The same for the rice straw OMD depression at 1 kg peanutt cake/day.

In conclusion, peanutt cake raises the nitrogen, energy and phosphorus levels of rations based on rice straw the limitation of this concentra-t-e to 10 per cent of the diet and use of urea for nitrogen deficiency could allow semi intensive meat production (see tables 5 and 6)

1.2 - Coi-ton seed

Cotton seed can be associated with rice straw in the south Senegal (Casamance and Tambacounda). This concentrate represented 26 p 100 of the ration based on rice straw.

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Table 6 suggests an addition of urea to reach the semi intensive beef production al lowed by energy level of the ration

1.3 - Rice agro indus-triai by products

Rice break, polishing an bran represent great feed ressource potential avai lable in the aeria of rice production.

Used alone or in association (w/w) with maize bran, rice polishing gives an adequate supplementation of rice straw and improvod significantly ($P \leq 0,05$) its OMD (Table 4).

In both cases the ration has been rich in energy and could support intensive fattening of cattle with a nitrogen source such as urea were added (Table 6)

Rice break is rich in starch. It represented 28 per cent of the ration. This level has been too high and could explain the significant ($F \leq 0,051$ dépression of rice straw OMD. This by-product should be reserved to poultry .

1.4 - Urea and mol asses

It is wel l documented that urea is a cheap nitrogen source able to improve intake and OMD of low qual ity roughage.

Wi thout a good energetic source, ruminant use of urea is poor.

In Senegal, molasses and rice straw are avai lable in the same aeria (Senegal rive val ley). Jhe arsociatlon of rice straw, molasses and urea (20 p 100) gives a mixture wel l consumed by ruminants. An addition of peanutt cake and minerais could allow intensive or semi intensive beef fattening.

TABLE 5 : NUTRITIVE VALUE OF RATIONS BASED ON RICE STRAW

RATIONS	SPECIES	NUMBER OF TRIALS	INGESTIBILITY		ENERGY		PROTEIN		MINERALS	
			g/100 kg BW	g/kg p 0,75	CMD p 100	FU kg DM	DMA p 100	DCP g/kg DM	Calcium g/kg DM	hosphor g/kg
RS*	CATTLE	15	1872 ±209	74 ±9	64 ±4	0.5± 0.0	-19.0	3 ± 4	[illegible]	0.7
RS	SHEEP	15	2053 ±253	48 ±7	58 ±4	0.4± 0.0	-11.5	0 ± 13		
RS + Cotton seed	"	7	2545 ±162	60 ±4	57 ±4	0.5± 0.0	50 ±6.1	45 ± 10	2.4 ±0.8	1.9±
RS + Peanutt cake 500 g/day	CATTLE	8	2365 ±355	95 ±15	63 ±13	0.4± 0.0	53.8 ±7.7	35 ± 9	1.8 ±0.4	1.1± 0
RS + Peanutt cake 1 kg/day	"	3	,504 ±52	100	64	0.5± 0.0	72.8 ±1.2	76	1.6	1.6
RS + Peanutt cake 250 g/day	"	2	3485 ±16	101	69	0.6± 0.0	44.8	34	2.3	0.9
RS + Rice polishing	"	13	2599 ±435	102 ±22	74 ±3	0.7± 0.0	66.6 ±10.(	42 ±7	2.0 ±0.4	4.0±
RS + Rice polishing	SHEEP	2	2890 ±95	65	55	0.5± 0.1	"	43	-	
RS + Peanutt cake 10 p 100	"	2	2290 ±143	53	57	0.3' 0.1	73.2	107	3	2.5
RS + Rice polishing + maize bran	CATTLE	6	3351 ±373	137 ±21	79 ±1	0.8± 0.0	64.3 ±3.1	33 ±1	1.7 ±0.1	2.4±
RS + Rice break	"	6	3007 -1157	69 ±5	58 ±3	0.4± 0.0	21.3 ±6.2	10 ±3		
Urea processed rice straw + urea 1,5 p 100	SHEEP	1	1695	40	56	0.4	74.9	106	0.5	
RS + molassis urea	"	2	2626 ±559	61	59	0.4± 0.1	43.5	32	2.3	

*RS = Rice straw

TABLE 6 : LEVEL OF PRODUCTION ALLOWED FOR UBT BY RATIONS BASED ON RICE STRAW

RATIONS	SPECIES	LEVEL OF PRODUCTION			
		ENERGY	DIGESTIBLE CRUDE PROTEIN	MINERALS	
				CALCIUM	PHOSPHORUS
RS	CATTLE	Maintenance+100g/day	: maintenance	maintenance	< maintenance
RS	SHEEP	: Maintenance	< maintenance	..	
RS + Cotton seed 26 p 100	"	Maintenance+300g/day	Maintenance+ 100 g/day	Maintenance+100 g/day	Maintenance+100g/day
RS + Peanutt cake 500 g/day	CATTLE	" +250g/day	Maintenance	Maintenance	< maintenance
RS " 1kg/day	"	" +300g/day	" +750g/day	< maintenance	Maintenance+ 100g/day
RS " 250g/day	"	" +500g/day	Maintenance	Maintenance+100g/day	< maintenance
RS + Rice polishing 22 p 100	"	" +1kg/day	Maintenance+ 90g/day	maintesance	> maintenance
RS + Rice polishing 45 p 100	SHEEP	" +500g/day	" +250g/day		
RS + Peanutt cake 16 p 100	"	: maintenance	" +1kg/day	Maintenance+250g/day	Maintenance+500g/da
RS + Rice polishing+ maize bran 20 p 100	CATTLE	Maintenance+1kg/day	" +100g/day	Maintenance	Maintenance+500g/day
RS + Rice break 28.5 p 100		Maintenance+300g/da	< maintenance		
Urea processed rice straw + urea 1.5 p 100	SHEEP	: Maintenance	Maintenance+560g/day	< maintenance	
RS + (molasses + urea)20p100	SHEEP	Maintenance+100g/day	Maintenance		-

TABLE 7 : UREA TREATMENT OF CEREAL STRAW

COMPARISIGN OF RICE, MILLET, MAIZE, AND SORGHUM STRAWS

CEREAL STRAWS		MAT (p. 100)	DMS (p. 100)	MSVI g sec/kg (p 0,75
Rice straw	Processed	7.9 n = 1	54.48 ± 3.76	61.0 ± 9.5 n = 6
	Control	4.5 n = 1	42.8 ± 3.6 n = 6	47.7 ± 2.8 n = 5
Maize straw	Processed	14.9 n = 1	57.2 ± 4.8 n = 6	52.6 ± 10.3 n - 6
	Control	3.9 n = 1	49.3 ± 2.4 n = 6	39.5 ± 4.6 n = 6
Millet straw	Processed	14.10 n = 1	58.8 ± 5.5 n = 4	56.1 ± 3.4 n - 4
	Control	8.4 n = 1	39.2 ± 6.4 n = 5	31.5 ± 6.8 n = 4
Sorghum straw	Processed	14.60 n = 1	65.1 ± 2.7 n = 6	68.4 ± 3.4 n = 6
	Control	4.2 n =	47.2 ± 4.7 n = 2	49.8 ± 6.2 n = 5

TABLE 8 : EFFECT OF UREA CONCENTRATION ON DRY MATTER DIGESTIBILITY AND INTAKE OF PROCESSED CEREAL STRAWS

CEREALS	UREA CONCENTRATION p 100	DRY MATTER DIGESTIBILITY p 100	DRY MATTER INTAKE g/kg p. 0,75
w/w mixture			
millet straw	3	42.4 4 1.1 N = [redacted]	30 ± 7 N = 4
+ maize straw	5	56.0 ± 8.4 N = 4	41 ± 14 N = 4
+ Sorghum straw	6	50.0 ± 6.0 N = 3	34 ± 5 N = 3

TABLE 9 : DRY MATTER DIGESTIBILITY OF MILLET STRAW TREATED WITH Na OH

INCUBATION TIME	Na OH CONCENTRATION			
	30	40	50	60
24 hours	52.6	56.1	58.6	62.5
48 hours	52.4	57.6	57.2	62.6
96 hours	52.2	56.4	57.9	62.8

Control = 36 p 100

From L.N.E.R.V. 1977 annual report

TABLE 10 : CHEMICAL VALUE OF Na OH TREATED MILLET STRAW

MILLET STRAW / ANALYSIS g/kg DM	Dry matter	ASH	Ether extract	Crude fiber	Crude protein	P	CA	ilica	Nitrogen free extract	ADF	Lignin	Lignin/ ADF	NDF
Control	928	98	2	406	36	[illegible]	3.14	[illegible]9	448	546	86	158	802
(1) (2)													
Mil 30 - 24	973	132	9	402	41	1.46	3.77	[illegible]1	415	522	91	174	527
Mil 40 - 24	978	137	8	410	42	1.52	4.94	29	402	500	90	180	512
Mil 50 - 24	973	139	9	399	40	1.47	4.12	[illegible]8	413	510	92	180	507
Mil 60 - 24	968	157	7	391	39	1.34	4.94	23	407	499	80	160	491
Mil 30-- 48	948	124	10	398	44	1.43	3.47	23	424	512	78	152	517
Mil 40 - 48	961	132	9	387	43	1.52	3.72	24	429	525	81	154	520
Mil 50 - 48	966	142	8	384	39	1.42	3.42	21	427	523	82	157	704
Mil 60 - 48	955	152	8	394	44	1.36	3.33	18	402	531	78	147	688
Mil 30 - 96	974	136	9	407	47	1.65	4.27	26	401	526	66	125	794
Mil 40 - 96	972	142	9	402	43	1.33	4.28	33	404	540	82	152	788
Mil 50 - 96	971	146	8	364	43	1.36	3.85	27	438	503	74	147	702
Mil 60 - 96	975	179	7	–	49	1.47	4.54	29	435	489	65	133	678

Source : LNERV ANNUAL REPORT 1977

(1) : Na OH concentration

(2) : incubation time

II - ALKALI TREATMENT OF CEREAL STRAW

2.1 - Urea treatment of cereal straw

Intake, digestibility and nitrogen concentration have been improved by urea treatment of rice, millet , sorghum and maize straw (see table 7).

Rice straw cannot be compared to others roughages because it has been sundried. Mai e, millet and sorghun straw have been offerad humid. The nitrogen level of rice straw has been under estimated.

Compared to maize and sorghum straws, millet straw gave a superior improvement of intake and digcstibility while the first had a highcr capacity of nitrogen fixation.

Tho results in table 8 describe the effect of urea concentration on cereal straw improvement . 5 p 100 has been the optimal level.

2.2 - Na OH troatment of millet straw

Available results show a positive influence of Na OH concentration on millet straw digestibility (table 9) while chemical value of straw didn't undergo any change (Table 10).

As emphasized by JACKSON (1979) 6 p 100 has been a good concentration.

The incubation time had no major influence in the imprevement of millet straw. The minimal time of 24 hours is sufficient.

CONCLUSION

The ruminant utilisation of available cereal straw could be greatly Improved in Senegal.

Early harvesting and conservation should be adviced to farmer.

Cereal straws represent an important source of energy, Optimal recuperation could help farmers to meet high demand of dry matter and energy for milk and meat production.

Howevor their low concentration in nitrogen, minerals and digestiblo energy requires a good supplementation. Preference should be given to agro-industrial by product available in the aerias of cereal production.

In the grounut basin and the south, cerealstraw can be supplemented by peanutt cake, cotton seed, sorghum, millet and rice brans.

Rice agro-industrial by products (rice polishing, rice bran) in association with rice straw can achieve higher production levels in the southern and northern part of Senegal.

In senegalese river valley, tho intensification **of** animal production could be realized through the combinaison of rice straw, molasses, urea an rice bran Import of feed ressources is not necessary in that area.

Treatment with urea is the most promising alternative solution in order to enhance stra utilisation by ruminant, Urea is already available at low cost. Moreover it is an important source of non protein nitrogen and farmer have a traditic tradition to use it as a fertilizer.

On farm research should be geared towards comparing the economic feasibility of two alternative solution : treatment and supplementation of cereal straw with urea.

SUMMARY

Within the framework of agriculture and livestock association, low quality crop residuos emerge as one of feed ressources wich would play an important role in the attempt of meeting dry mat-ter and energy requirements of ruminants in Senegal.

In 1986, 887 820 tons of millet, maize, sorghum and rice grains have been harvested. Estimated straw output is 4 800 000 tons.

In supplementing this available low quality roughags preference should be given to available agro-industrial by producl spresent in the area of cereal production in order to avoid transport cons-train-k Groundnutt rice by product and cereal brans have given very performing ration for milk and meat intensive or semi intensive production,

Treatment with urea is the rnost promising alternative solution in ordcr to entrance straw utilisation by ruminant. Urea is already available at low cost moreover it is a sourco of non protein nitrogen and fat-mers have a tradition to use it as fertilizer.

On farm research should be geared tocards comparing the economic feasability of two alternative solutlon : treatment and supplementation of cereal straw with urea.

BIBLIOGRAPHIE

1 - CALVET (H.), VALENZA (J.), BOUDERGUES (R.), DIALLO (S.), FRIOT (D.), CHAMBRON (J.) (1974) - La paille de riz dans l'alimentation animale au Sénégal. 1. Analyses bromatologiques. Digestibilité in vivo et in vitro. Bilans azotés et minéraux.
Rev. Elev. Méd. Vét. Fays trop , 27 (2) : 207-220.

2 - JACKSON (M.G.) (1979) - Le traitement des pailles pour l'alimentation des animaux. Evaluation de la rentabilité technique et économique,
Revue FAO ed., 1979, 68 p;

3 - ISRA - LNERV (1977) - Rapport sur le fonctionnement de l'année 1977.

4 - ISRA - LNERV (1980) - Rapport sur le fonctionnement de l'année 1982. pp : 78-79.

5 - FRESTON (T.R.), LENG (R.A.) (1984) - Supplementation of diets,based on fibrous residues and by products.
In : Straw and other fibrous by products as feed
F. Sundstol and E. owen eds. Eisvier Press. Amsterdam H 373-413.

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