

AZOLLA AS A FOOD FOR RABBITS IN AFRICA

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INTRODUCTION

One of the major problems confronting the peoples of the Third World is protein deficiency and especially the deficiency of high quality protein. One can envisage several solutions. One of these is the use of leguminous plants which fix large quantities of atmospheric nitrogen by association with micro organisms such as the leguminous plants which are in symbiosis with *Rhizobium* or *Azolla*, a fern, in symbiosis with *Anabaena*.

Another often used method is the breeding of small animals (fish, fowl, rabbit) which efficiently transform ingested nitrogenous materials into high quality proteins.

It is therefore attractive to envisage a production of proteins by combining the two methods. The plant provides the nitrogenous material; the animal produces high quality protein from this thanks to a transformation.

In light of the above we decided to test the efficiency of *Azolla* in rabbit culture.

The average rabbit female produces 60 kg of live weight every year, in fact approximately 35 kg of meat (more than a sheep!). Rabbit meat is a typically "modern" meat, poor in calories and rich in protein.

The lipid fraction of rabbit meat is high in polyunsaturated fatty acids and especially in linoleic and linolenic acids. This creates, for this meat, an interesting dietetic function in human alimentation.

The rabbit is an interesting animal due to its small size, its rustic character and its prolific nature. Its culture is relatively easy if good sanitary conditions are maintained, and the necessary preventive measures are taken at the appropriate time. Family production and also large scale breeding are possible in both temperate and tropical regions (Benin, Ghana, Guinea, Mexico, Rwanda, etc...). At the present time we have observed an increase in the efficacy of rabbit culture in Africa.

That a campaign in favour of the extension of rabbit culture be successful, it is important that the needs of the animal do not interfere with the essential needs of man; the commercially available rabbit fodder, at this moment, essentially contains, for the main part, cereals and soja; these are high grade expensive nutrients entering directly into the human alimentation chain.

A partial replacement of these products by those of vegetable origin could therefore seriously reduce the price of rabbit production.

MATERIAL AND METHODS

Control of growth rate :

Varieties of Azolla used are :

Azolla pinnata collected and dried at Richard Toll, Senegal,

Azolla caroliniana collected at Tihange, Belgium.

10 rabbits (Blanc de Termonde) weaned at 30 days, non treated, raise in individual cages under controlled conditions. Food and water distributed *ad libitum* .

Statistical analysis; ANOVA 1 (diet effect) and Duncan's test.

The composition of the complex granules is given below (Tab. 1).

DIETS

	T	A20	A40	A60
Composition (%)				
Sun dried Azolla	0,0	20,0	40,0	60,0
Oat meal	15,0	25,0	16,0	0,0
Dehydrated lucerne	40,0	30,0	20,0	0,0
Soya meal 44	10,0	8,0	4,0	0,0
Sunflower meal	25,0	7,0	0,0	30,0
Manioc	0,0	0,0	10,0	30,0
Molasses	8,0	8,0	8,0	8,0
Minerals and vitamins	2,0	2,0	2,0	2,0
Chemical analysis				
Dry matter (% of product)	88,7	89,1	89,9	92,8
Total crude protein (% DM)	23,1	18,1	13,4	9,4
Lipids	4,5	5,6	4,8	5,6
Crude fibre	18,6	15,2	11,5	7,8
Total ash (% DM)	8,9	14,8	20,7	25,4
Crude energy (kcal/kg)	4381,7	4268,2	3951,1	3559,3
Organic matter	91,1	85,3	79,3	74,6
NNE	44,9	45,7	48,5	49,8

Tab. 1 : Chemical analysis or the experimental diets.

Test of appetency :

- 9 six week rabbits. In individual cages - controlled conditions.
- 3 removable feeding boxes per cage.
- 3 g of dry *A. caroliniana* (C.A.), 3 g *A. microphylla* (M.I.) and 3 g *A. pinnata* (P.I.) are presented to each individual until the half or less (estimated visually) of that sample the most preferred is consumed.

RESULTS

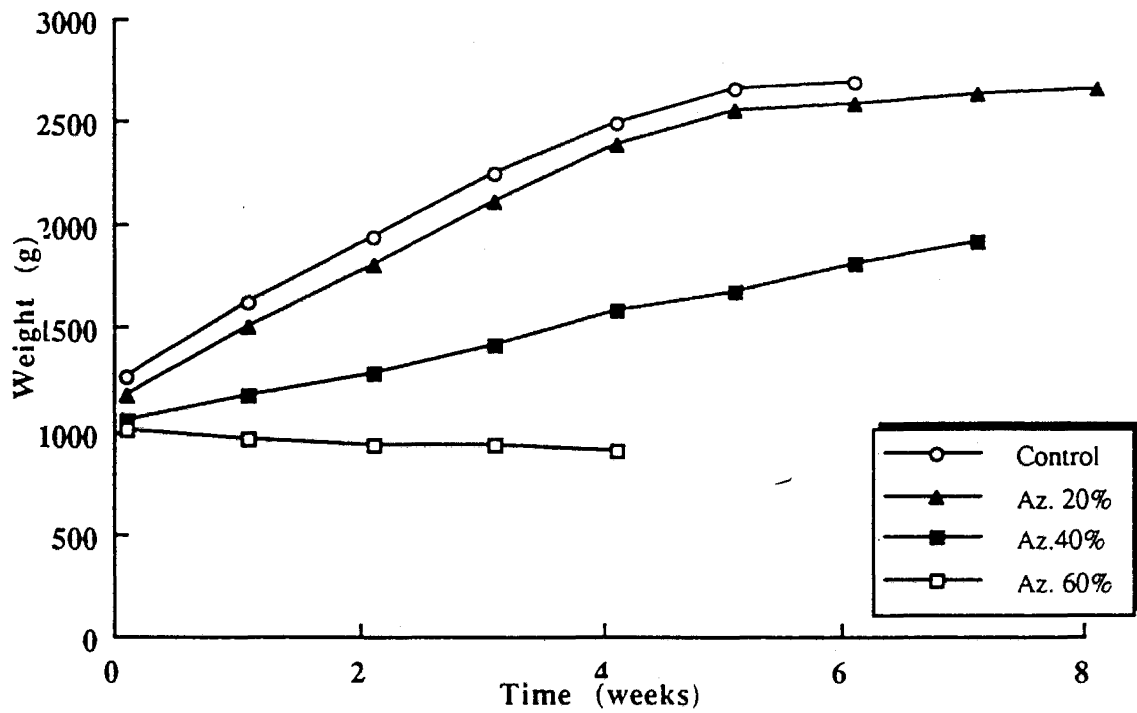


Fig. 1 : Growth curves of the rabbits as a function of diets.

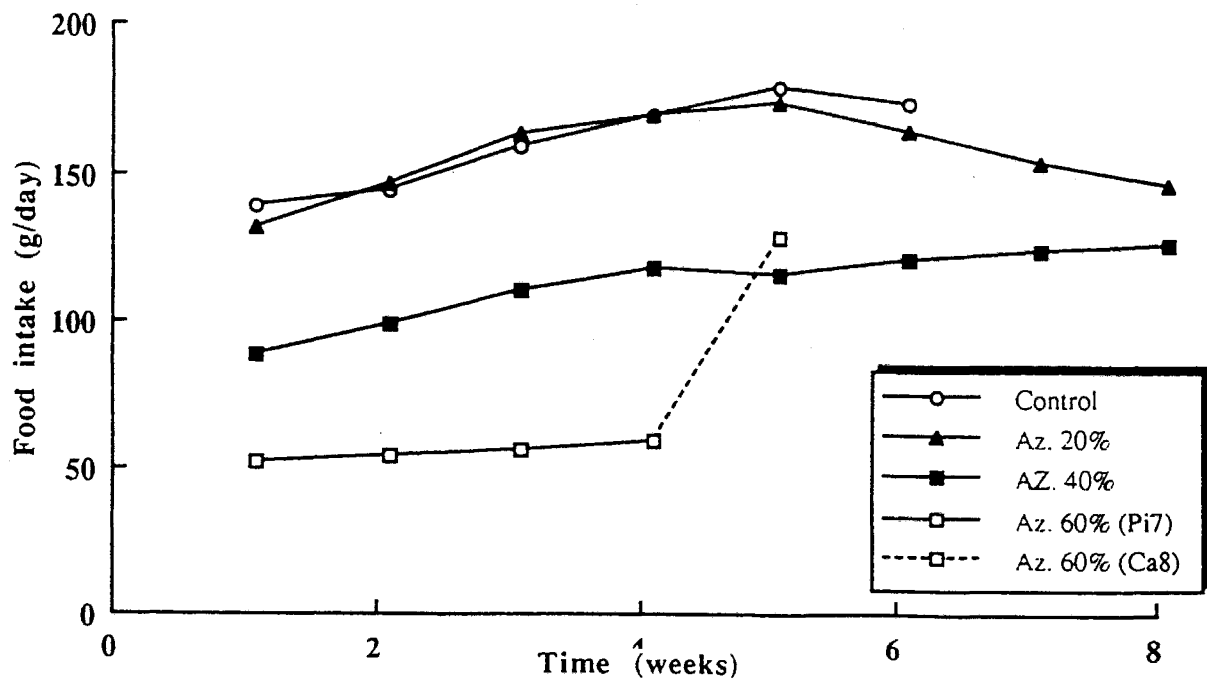


Fig. 2 : Intake of pellets at 0, 20, 40 and 60% *Azolla pinnata* var. *imbricata* .

From the 5th week, the diet of 60% *A. pinnata* is replaced by a diet of 60% *A. caroliniana* .

Trials conducted during six days with three ecotypes of each species of *Azolla* , randomly mixed, given the following results (Tab. 2) . .

Days	CA	MI	PI
1	33 (27)	48 (83)	19 (77)
2	38 (8)	36 (69)	25 (77)
3	48 (58)	31 (69)	21 (77)
4	41 (58)	31 (65)	28 (88)
5	36 (27)	50 (69)	14 (88)
6	36 (27)	47 (83)	17 (77)
Average	39 a	41 a	21 b

Tab 2 : Average percentage of intake (in g) of 3 species of *Azolla* : CA, *A. caroliniana*; MI, *A. microphylla*; PI, *A. pinnata*..

The figures in brackets represent the ecotype of *Azolla* used.

DISCUSSION

The evolution of body weight of those animals following diets T and A20 (Fig. 1) is not significantly different to that described by Ouhayoun (1984) and Jouve (1987). Diet A40 only allows a slow growth, whereas diet A60 causes a slight diminution of weight.

The poor results obtained with diets A40 and A60 could be attributed to :

- the overall composition not corresponding to the essential needs of the animal,
- a high ash content (of partially exogenous origin),
- a dislike of the strain of *Azolla* presentend.

Intake curves show that unsatisfactory results are correlated to the consumption of less food which suggest a high degree of dislike. However, at the end of the 4th week, those rabbits having received A60 which includes *Azolla pinnata* (ashe: 25,4%, total crude protein: 9%), then received another diet containing *Azolla caroliniana* (ashe: 15,7%, total crude protein: 17%) for one week. The average uptake increased from 54 g/day to 127 g/day.

Whatever choice of food proposed to the rabbits showed a preference for *A. caroliniana* to *A. microphylla* . The dislike of *A. pinnata* has already been observed in certain fishes, and, more recently, in an insect predator on *Azolla* , *Rhopalorophum nymphaeae* .

CONCLUSIONS

It is indicated that diet A60 (60% of incorporation) is not suitable for fattening the rabbit, but the choice of an acceptable strain of *Azolla* could improve the quality.

Diet A20 (strain P.I.7) and, to a lesser extent, diet A40, give satisfactory results. However, all observations made must take into account all results of appetite. It is clear that the preference for one strain to another can influence the overall picture. When compared to diet A20, the poor results of A40 could depend on several factors: a composition which does not correspond to the essential needs of the subject, a high proportion of ash (of exogenous origin) a marked dislike due to the higher incorporation of a little appreciated strain (P.I.7).

With regards to appetite, the strains *A. microphylla* and *A. caroliniana* are distinctly more appreciated than *A. pinnata*. This observation is interesting as it corresponds to observations already described for certain fishes (Antoine *et al.*). The reason for this selectivity could be due to repulsive chemical substances already demonstrated in the strains

To conclude, the choice of that strain the most appreciated by the rabbit, and the actual composition of a balanced diet would probably permit an increase, of around 20%, the rate of *Azolla* added to the diet.

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SUMMARY

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Azolla pinnata, var. *imbricata* (strain ADUL-7P1) collected in an irrigation canal (Richard-Toll, Senegal) where it was growing spontaneously, has been sun-dried and incorporated in pellets for feeding rabbits, at rates of 20, 40 and 60% D.W., replacing components like sunflower and soybean cakes from a standard regime. Growth rate and quality of rabbits were not affected by the 20% regime as compared to the control, but 40% gave poor results and 60% did not allow any growth. It has to be noted that the *Azolla* used in this experiment were very abnormally poor in N (2,36%) and rich in ash (38%), mainly from exogenous origin. Furthermore a preliminary experiment on appetency of varieties *A. caroliniana*, *A. microphylla*, *A. pinnata* var. *imbricata* and *A. pinnata* var. *pinnata* shows that *A. pinnata* are clearly less appreciated by rabbits, than the other species. It is concluded that *Azolla* could be an interesting substituent of some expensive or unavailable components of rabbits diets if the proper strains are selected.