SLURRY EVALUATION FOR THE PRODUCTION OF HYDROPONIC FODDER FOR RABBITS *Oryctolagus Cuniculus* AND VERMICOMPOST AS SUBSTRATUM FOR *Ficus* INOCULATED WITH ARBUSCULAR MYCORRHIZAE *Glomus*

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ABSTRACT

The hydroponic fodder is of great nutritious quality and it is easy to produce. The dung drain slurry can be used in its production as well as for producing compost, which is a substrate for plants which, inoculated with beneficent fungi or arbuscular mycorrhizae *Glomus*, decrease the costs of chemical fertilizers because these fungi improve the absorption of minerals. The aim of this research was to evaluate slurry to produce hydroponic fodder (FH) from wheat *Triticum aestivum* L., the hydroponic fodder as a diet for male rabbits and vermicompost as a substrate to grow *Ficus* inoculated with arbuscular mycorrhizae (AM) *Glomus*. Different mixtures of nutrient solution-slurry were evaluated (S-NS) to produce hydroponic fodder. The best mixture was used for the production of FH to the sustenance of rabbits *Oryctolagus cuniculus*. The residues were vermicomposted with earthworms *Eisenia foetida*. The vermicompost was used as substratum for sowing and inoculation with AM of rooted plants of *Ficus*. The results indicate the possibility to produce rabbits in a sustainable way, with the saving of chemical fertilizer by the use of slurry and vermicompost as substrate of *Ficus* produced in nurseries and inoculated with AM.

Key words: Slurry, hydroponic fodder, rabbits, arbuscular mycorrhizae.

INTRODUCTION

CAPULIN *et al*. (2001) discovered that barley *Hordeum vulgare* L. irrigated with a liquid extract of acidulate bovine, showed a good development and higher phosphorus concentrations, nitrogen, sulphur and boron compared with the one irrigated with a nutrient solution. BUSTOS *et al*. (2000) suggest the efficient use of water by the production of hydroponic fodder of barley and wheat *Triticum aestivum* L. for goats in semi-desert conditions. HARRIS *et al.* (1981) found that the hydroponic fodder produces plenty of fiber, which is necessary for a better digestion and nutrition of rabbits. BAUTISTA (2002) determined that rabbits fed with a balanced food developed a higher weight than rabbits fed with hydroponic fodder. However, there was a correlation between the rabbit's weight and the hydroponic given as a diet. MANJARREZ *et al.* (1999) found that the production of chili *Capsicum annum* L. favors the inoculation of arbuscular mycorrhizae on additional substrate with different doses of vermicompost. LÓPEZ, 1996 (cit. ALBORES, 2000) found that the mixtures of ground-vermicompost 1:1 and 3:1 for the

cultivation of Christmas eve plants *Euphorbia pulcherrima* inoculated with arbuscular mycorrizae are suitable for the application of chemical fodders.

MATERIAL AND METHODS

1st. Experiment. Evaluation of mixtures slurry-nutrient solution to the production of hydroponic fodder (FH) of wheat.

The experimental design was at random with 12 treatments and four repetitions for each one. The rabbit dung was transformed by worms *Eisenia foetida* for five months. The drained slurry (S) was taken and packaged in plastic containers and mixtures were prepared with sterile and non sterile nutrient solutions (NS): slurry 80 % + 20 % nutrient solution, slurry 60% + 40% nutrient solution, slurry 40% + 60% nutrient solution, slurry 20% + 80% nutrient solution and also a nutrient solution 100% and slurry 100%, both sterile and non sterilized and also acidified with sulphur acid (pH 6.5). The wheat seeds were in water for 24 hours. Then they were transferred (50 cc) onto plastic trays. They were irrigated manually in the morning and in the afternoon at first with water and then with the different mixtures of slurry-nutrient solutions for 15 days at the nursery. At the end of the experimentation the variables wet weight (WW) and dry weight (DW) of the FH produced were registered. Data were processed by analysis of variance and significant means were tested according to LSD test ($p<0.05$) (SAS, 1990).

2nd. Experiment. Production of hydroponic fodder (FH) of wheat for rabbits breeding.

The experimental design was at random with three treatments, S 20% + 80% NS no sterile, S 40% + 60% NS sterile and nutrient solution 100% no sterile, with 3 repetitions (rabbits) for each one. The rabbits were domestic male rabbits of 5 weeks of age, they were acquired in a local farm and they were set in metallic cages for their maintenance. From the first experiment the nutrient solution which gave the best results were selected in order to produce FH, S 20% + 80% NS and S 40% + 60% NS and it produced in the same way as the first experiment. The FH was sown and given as food to the rabbits for seven weeks in which the animals weight was registered. Data were processed by analysis of variance and significant means were tested according to LSD test ($p<0.05$).

3rd. Experiment. Evaluation of proportions of slime-vermicompost on *Ficus* inoculated with arbuscular mycorrhizae (AM).

This experiment was at random with four treatments: inoculated plants in slime-vermicompost sterile 1:1, inoculated plants in slime-vermicompost sterile 1:3, non inoculated plants in slime-vermicompost sterile 1:1 and non inoculated plants in slime-vermicompost sterile 1:3, with 5 repetitions each one. Stakes of *Ficus* of 9 cm of length from the Botanical Garden of The Universidad Autónoma de Guerrero were obtained and disinfected in a substance of Captan 500 ppm, and then they were immersed in another substance of commercial hormones (Radix) of 1,500 and 10,000 ppm and they were sown in a mixture of agrolite-waste pulp of disinfected coconut contained in a tray with 49 holes. They were taken to the greenhouse and irrigated with common water

every eight minutes for 5 seconds for 6 weeks. Then it was just given a morning irrigation for two more weeks for the hardening and the complete rooting of the plants. After they were put in black plastic bag of 1,500 cc containing disinfected substratum and non disinfected, slime-vermicompost 1:1 an 1:3. By the time of the transplant they were inoculated with 2 g of inoculant of MA *Glomus* directly to the roots. The plants were kept in the greenhouse for 16 weeks with manual irrigation of common water. During the harvest it registered the following variants: wet weight of foliage (WWF), dry weight of foliage (DWF), number of branches (NR), height (H), number of leaves (NL), stem diameter (SD), wet weight root (WWR), dry weight root (DWR) and percentage of arbuscular mycorrhizae (%AM). Data were processed by analysis of variance and significant means were tested according to LSD test ($p<0.05$).

RESULTS AND DISCUSSION

The results in the table 1 indicate significant differences in wet weight (WW) and dry weight (DW) from the hydroponic fodder. The treatments (T) 12, 6 and 7 had a higher WW; with intermediate weight the T 11, 5 and 1; with less WW the T 4, 10, 2 8 and 3, in descending order. The T 1, 12, 5, 6 and 7 had a higher DW; with less DW the T 9, 11, 2, 3 and 8, also in descending order.

It suggests that the best treatments were due to the best mineral concentration and pH from the nutrient solution (6.5-7.0), these factors influenced on the best mineral absorption by the plants. Showing similar with CAPULIN *et al*. (1999) when the liquid extracted from bovine dung acidulous showed a better development; therefore with BUSTOS *et al*. (2002) who propose the production of FH of wheat and barley in rustic conditions of semidesert for goat farmers, being the FH of high quality improving the use of water.

Table 2 contains the results of the rabbits weight in seven weeks which were fed with FH produced with the treatment 1 (T1), treatment 2 (T2) and treatment 3 (T3). The rabbit's weight from the second to the fifth week had no significant differences between the treatments. It only had significant differences between the rabbits to the T1 in the first and sixth week with the T2 and T3. It suggests that the significant differences were due to their natural development and change of diet. Before the experiment they were fed with balanced food and in the case of the significant differences to the rabbits from the sixth week, due to the environmental stress. In the seventh week it had no significant differences between treatments.

The lack of significant differences in the rabbits fed with FH produced with a different nutrient solution suggests that the feeders had the same nutritional quality that covered their needs and therefore they had adequate amounts of fiber for its best digestion as HARRIS *et al*. (1981) indicate. Also agrees with BAUTISTA (2002) due to the rabbits from this experiment increased their weight as a result of the natural physiological change with the advanced of their age, this suggests the possibility to produce FH with any of the nutrient solution used, the reduction of using chemical fertilizers and therefore the recirculation of the animal waste.

Table 1. Wet weight (WW) and dry weight (DW) of hydroponic fodder (FH) of wheat *Triticum aesticum* L. irrigated with different nutrients solutions (NS).

Treatments (T)**	WW (g)	DW (g)
1. NS 100%	141.0 bcd	18.0 a
2. S 100%	102.0 g	10.0 ef
3. 80% S + 20% NS	98.0 g	10.0 ef
4. 60% S + 40% NS	124.0 def	12.0 cde
5. 40% S + 60% NS	139.0 cde	16.0 abc
6. 20% S + 80% NS	160.0 ab	16.0 ab
7. NS100%	153.0 abc	16.0 ab
8. S 100%	99.0 g	8.0 f
9. 80% S + 20% NS	121.0 ef	11.0 def
10. 60% S + 40% NS	108.0 fg	11.0 ef
11. 40% S + 60% NS	144.0 bc	15.0 bcd
12. 20% S + 80% NS	169.0 a	18.0 ab

*Means in the same column with different letter differ significantly (P<0.05).
** 1-6, sterile; 7-12, no sterile.
S = Slurry; NS = Nutrient solution.

Table 3 shows the results of different variables, wet foliage weight (WFW), dry foliage weight (DFW), number of branches (NB), height (H), number of leaves (NL), stem diameter (SD), wet root weight (WRW), dry root weight (DRW) and percentage of arbuscular mycorrhizae (%AM) evaluated in *Ficus,* developed in different proportions of slime-vermicompost inoculated with arbuscular mycorrhizae (AM) *Glomus*. There were significant differences in WFW among the plants of the T1, T2 with T3, but not with the ones of T4; in SD there were significant differences among the plants of T1 and T2 and T4 with T3; in WWR there were significant differences between the plants from the T1 with the T3, but not with the T2 an T4; in %AM there were significant differences between the plants of T1 and T2 with the T3 and T4; in the variables DWF, NB, H, NL and DWR there were no significant differences. The mentioned before shown that the inoculation of *Glomus* favored the development of *Ficus* in the slime-vermicompost proportions, agreeing with MANJARREZ, *et al.* (1999), who obtained bigger production of green pepper *Capsicum annum* L. at being inoculated with MA; with LÓPEZ, *et al*. (1996, cit. ALBORES, 2000) who found the best development of Christmas eve plants *Euphorbia pulcherrima*, developed in mixtures of ground-vermicompost and inoculated with AM. Making the suggestion that the dungs, from rabbits in this case, can be used in the production of *Ficus* plants, with a better efficiency if it is inoculated with *Glomus*.

Table 2. Weight of rabbit *Oryctolagus cuniculus* fed with hydroponic fodder of wheat *Triticum aestivum* L. produced with different percentage of nutrient solution (NS) and slurry (S).

Rabbits weight (g) per week	Treatments (T)		
	1. NS 100%	2. S 20% + 80% NS	3. S 40% + 60% NS
First week	977 b	1213 a	1070 a
Second week	1007 a	1240 a	1073 a
Third week	1163 a	1273 a	1263 a
Fourth week	1280 a	1430 a	1329 a
Fifth week	1403 a	1645 a	1380 a
Sixth week	1440 b	1660 a	1473 a
Seventh week	1467 a	1703 a	1513 a

*Means in the same row with different letter differ significantly (P<0.05).
S = Slurry; NS = Nutrient solution.

Table 3. Proportions slime-vermicompost (1:1, 1:3) and evaluated variables in *Ficus,* wet weight of foliage (WWF), dry weight of foliage DWF), number of branches (NB), height (H), number of leaves (NL), stem diameter (SD), wet weight of root (WWR) dry weight of root (DWR) and percentage of arbuscular mycorrhizae (%AM) *Glomus*.

Treatments (T)	V a r i a b le s								
	WWF	DWF	NB	H	NL	SD	WWR	DWR	%AM
1. Inoc. 1.1	39 a	12 a	20 a	48 a	61 a	0.85 a	37 a	9 a	53 a
2. Inoc. 1:3	32 a	12 a	17 a	50 a	67 a	0.82 ab	34 ab	8 a	54 a
3. No inoc. 1:1	22 b	9 a	19 a	46 a	54 a	0.55 c	20 b	7 a	0 b
4. No inoc. 1:3	27 ab	9 a	19 a	46 a	53 a	0.72 ab	28 ab	5 a	0 b

*Means in the same column with different letter differ significantly (P<0.05).

CONCLUSIONS

1. The 100% sterile slurry and no sterile did not affected the production of FH.

2. There was a bigger production of WW of hydroponic fodder with mixtures 20% S + 80% NS, NS 100% no sterile and 20% S + 80% NS sterile. And most DW with

mixtures SN 100%, 20% S + 80% NS, 40% S + 60% NS sterile and 20% S + 80% NS, NS 100% no sterile.

3. There were no significant differences in the rabbits weight fed with FH produced with NS 100% sterile, 20% S + 80% NS no sterile and 40% S + 60% NS sterile.

4. The *Ficus* plants inoculated and no inoculated with *Glomus* in proportion 1:1 slime-vemicompost had significant differences in the variables WWF, SD, WWR and %AM.

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