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Nitrogen transformations in the tobacco float tobacco system

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ABSTRACT

In order to investigate the possibility of using organic fertilizers in tobacco floating nursery, an experiment was conducted at tobacco research institute of Urmia in 2010. The experiment was done as factorial trail based on randomized complete block design (CRBD) with four replications. The levels of first factor were disinfected poultry manure, disinfected pigeon manure, a complete fertilizer (NPK) (15-5-30) and Marmarin fertilizer and the levels of second factor were involved two types of media (100 percent peat and 60 percent animal manure with 40 percent perlite media). During the experiment the concentration of nitrogen and ammonium levels were sampled and analyzed in nutrient solution after 10 days. The most of the nitrate and ammonium (48.82 and 63.8 ppm) were obtained from chemical fertilizer in the peat media at the first sampling whereas the lowest nitrate and ammonium (4.02 and 5.57 ppm) was belonged to chemical fertilizer at peat media and chemical fertilizer at perlite media with manure treatments, respectively, which was recorded at fourth stage of sampling.

Keywords: Organic Fertilizer, Planting media, Tobacco

INTRODUCTION

Nitrogen is one of the major nutrients of plants which its consumption is very important in the amount and time in floating pool. Usually, the amount of nitrogen is using twice phosphorus in treasury float stage (Fowlkes 2001). However, seedlings with high nitrogen consumption were crisp and juicy and were very sensitive to diseases. Also, the possibility of damage to seedlings in the high concentration of fertilizer salts increases (Smith and Spears 2003). Tobacco seedlings can absorb nitrogen in form of ammonium and nitrate ions, but before the urea usage plants must be converted to Ammoniacal-N (Smith and Spears 2003). In the floating nursery, air condition of media may affect the rate of change and transformation of nitrogen, because active bacteria in

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Nitrifications process are aerobic. Usually float in treasury, the culture level is less than 7 cm of pool water level, and the culture medium due to capillary rise of water in terms of moisture are close to saturation and so it may limit diffusion of oxygen in the culture medium (Pearce et al, 1998). Tobacco seedlings do not require a lot of phosphorus. Many farmers to show their interest for transplanting crops produced using organic fertilizers in developed countries. Because of the increasing tend to use of these products and sale has gradually increased. In University of Kentucky of American in 2002, preliminary tests on two types of organic fertilizers include manure; rotten wood and manure from the manure of seabirds with a complete fertilizer (16-5-16) were compared in pool float. Results of this investigation showed that transplants produced with manure droppings of seabirds was a little small compared to control, but transplanting transmitted was equal with control treatment. In rotten wood, transplanting small and N deficiency symptoms were observed them in comparison to control. Another experiment which involved commercial organic fertilizers comparison with a complete fertilizer in production of lettuce, indicated that by using of commercial organic fertilizers can be produced lettuce in the float pool and there was no significant difference in production with a complete fertilizer. Of course cultivars differed with each other in the amount of organic fertilizer. In 2007 in France for production ITB501 Burley variety in the float system, five manure contains extracts of sea grass, sugar beet, nettle extract, organic fertilizer Klasmann (including 5% and 50% wood chips and grits, respectively) and trays KKS Bio Tray Substrate were used. The soilless media used in the tobacco float systems typically does not contain any field soil (Poisson et al, 2008). Such mixes have several advantages over soil based systems. Many of the components used in the media (peat, vermiculite, and perlite) are nearly sterile, such that microbial populations are relatively low in the media as compared to field soils. This may reduce the potential for soil borne diseases, but it also means that populations of beneficial organisms, such as nitrifying bacteria, are low or nonexistent. The activity of some enzymes such as urease may be different in the soilless media compared to field soils. Studies with these media showed that urea hydrolysis generally occurs to a much greater extent than nitrification. It has been suggested that this is due to the stability of urease under adverse conditions, and to the presence of urease in peat (Elliot 1986). Nitrifying bacteria, on the other hand, are known to be relatively scarce in peat (Herlihy 1972).

MATERIAL AND METHODS

The research was performed in plastic greenhouses in Urmia Tobacco Research Center, located in North of Urmia City (37° 40.2′ N and 45° 2.2′ E) in 2010. The experiment was carried out as factorial layout based on a randomized complete block design (RCBD) with four replications. The first factor had three levels of fertilizers including, disinfected poultry manure, disinfected Pigeon manure, a complete fertilizer (15-5-30) and the second factor had two types of media (100 percent peat and 60 percent animal manure with 40 percent perlite). In this experiment, the pools of water to a height of 12 cm, length 60 cm and width 44 cm were used. Pool was built of brick and cement. After making the pool walls before filling water in the pond, its floor was leveling by using Balance Meter and a height of 5 cm layer of sand was poured into it and then it was

smoothed. The floor and walls of pool were covered with black plastic and the black are integrated. Plastic sheet 1.5 mm thick was used. Seeds planting were conducted by semi-automatic sowing machine GS100 model of Germa Company. One of the important factors in producing successful transplanting especially in the greenhouse floating nursery is water quality of floating nursery. Water quality used in this experiment was evaluated and the amount of bicarbonate, chloride, electrical conductivity and pH was determined (Table 1). High level of bicarbonate ions in water caused that we used 98% concentrated sulfuric acid for the adjustment of alkalinity of water. Acid requirements were calculated by using the following formula until Alkalinity value of used water brought down lower permitted limit (20 Meq per Liter).

Concentrated sulfuric acid volume (mm) = (bicarbonate ion Amount – 1) × 27× Nursery water volume

4.32= (6-1) ×27×0.032

Water height in floating nursery was fixed about 12 cm and this amount was maintained until the end of experiment. In this experiment, the required water level was about 0.320 m^3. In floating nursery, fertilizer application program must be configured according to nitrogen concentration and it should be between 75 to 100 ppm in pool water. In this experiment, the Gromor manure added 750 g/m^3in two steps to nursery water with formula fertilizer (30-5-15) (N-P-K) were used. At first phase fertigation was 665 g/m^3 of water media that Correct Amount fertilizer according to the water volume of water media is 0.032 m^3 was calculated exactly 21.3 g. The second phase fertigation was carried out when the transplants were to 4-leaf stage. At this stage was used the rest of 1,000 g/m^3 requirements fertilizer due to the volume of water was used exactly 32 g as a fertilizer source. Under the guidelines, Ridomil-Mancozeb fungicides were added in amount of 30 g/m^3 of water media. During the experiment the amount of nutrient solution was measured in float nursery systems that including, the amount of nitrate and ammonium (the first ten days, the second ten days, the third ten days, the fourth ten days). To combat aphids and fungal diseases was used 0.25, 2 and 1 per thousand confidor, Ridumyl Mancozeb and Benomyl in float system. Total numbers of transplanting and Available transplanting were counted as systematic in each tray. Statistical analysis was performed using by SAS and MSTATC statistical software.

RESULTS AND DISCUSSION

Nitrate levels

The results of analysis of variance showed that the main effect of fertilizer was significant in all four stages of nitrate sampling at 1% probability level. The main effect of planting media was significant at first, second and fourth stages of nitrate sampling at 1% and the third stages of nitrate sampling was significant at 5% probability level. Interaction effect of fertilizer × planting media was significant at each of four stages of nitrate sampling at 1% probability level. Present

the result of nitrate sampling at this study has conforms to results by Smith and colleagues (2001) at examining the production of tobacco transplant by float Treasury system.

Nitrate levels at the first stage of sampling

The results obtained of Compared means showed that the highest nitrate amount (48.82 ppm) was obtained from chemical fertilizer at peat media which was not statistically significant difference with poultry manure at peat media, Pigeon manure at peat media and chemical fertilizer at perlite media with manure. Lowest nitrate (15.65 ppm) was obtained from Marmarin fertilizer at peat media that showed no significant difference with marmarin fertilizer at perlite media and manure (19.67 ppm) (Table 2).

Nitrate levels at the second stage of sampling

The results of Compared means showed that the highest nitrate level at the second stage of sampling (27.25 ppm) was obtained with poultry manure treated in perlite media with manure that statistically significant difference with chemical fertilizer treated in perlite media with manure. Lowest nitrate (11.1 ppm) was obtained from marmarin fertilizer in peat media (Table 2).

Nitrate levels at the third stage of sampling

Results of compare means showed that the Maximum nitrate levels at the third stage of sampling (31.85 ppm) was obtained from of poultry manure Treated at perlite media with manure which no statistically significant difference with chemical fertilizer at perlite media with manure. The lowest nitrate (12.8 ppm) was obtained from marmarin fertilizer at peat media (Table 2).

Nitrate levels at the fourth stage of sampling

Comparison of data means showed that the Maximum nitrate levels at the fourth stage (13.68 ppm) of pigeon manure treatment in peat media and lowest (4.03 ppm) were obtained from chemical fertilizer treatments at peat media (5.08 ppm) that in term of statistical not significantly different with chemical fertilizer treatment at perlite media with manure fertilizer (Table 2).

Ammonium levels

The results of analysis of variance showed that the main effect of fertilizer at different stages of sampling were significant at 1% probability level. The main effect of planting media non-significant at the second and third stages but was significant at the first and fourth stages at 1% probability level. The interaction effect between fertilizer and planting media was significant at first, third and fourth stages at 1% and at second stage of sampling at 5% probability level.

Ammonium levels at the first stage of sampling

The results of compare means showed that the highest amount of ammonium at first stage of sampling (63.8 ppm) was from chemical fertilizer that had no statistically significant difference with Pigeon manure in peat media and the lowest value of ammonium (7.75 ppm) was obtained with marmarin fertilizer treatment in perlite media with manure fertilizer (Table 2).

Ammonium levels at the second stage of sampling

The results of comparison of data means showed that at second stage of sampling highest rate of ammonium (24.5 ppm) was obtained from poultry manure in perlite media with manure which had no statistically significant difference with Pigeon fertilizer at peat media, chemical fertilizer at perlite media with manure, chemical fertilizer at peat media, Pigeon fertilizer at perlite media and poultry manure at peat media. The minimum ammonium value (9.4 ppm) was resulted from the marmarin fertilizer at perlite media with manure, which there was no statistically significant difference with marmarin fertilizer at peat media (Table 2).

Ammonium levels at the third of sampling

Based on means comparison, the highest rate of ammonium (35.85 ppm) was from poultry manure at perlite media with manure and the lowest (12.85 ppm) was obtained of Marmarin fertilizer in peat media which in term of statistically there was no significant difference with marmarin fertilizer in perlite media and manure (Table 2).

Ammonium levels at the fourth stage of sampling

The results of compare means showed that the highest amount of ammonium (16.47 ppm) was from pigeon manure in perlite media with manure and lowest (5.57 ppm) was obtained from chemical fertilizer in perlite media with manure that had no statistically significant difference with poultry manure in perlite with manure, poultry manure in peat media and marmarin fertilizer in perlite media with manure (Table 2).

Conclusion

Nitrate and ammonium

because Chemical fertilizers break more quickly at Saturated water, it release more of nutrients in short time and the other hand, in chemical fertilizers, the total nitrogen at fertilizers as nitrate ions, so the highest levels of nitrate is at the first stage of sampling related to chemical fertilizer treatments. Marmarin due to having only 1% of total nitrogen, the lowest amount of nitrogen and

the others forms of nitrogen in compared with others fertilizers treatments. In water-saturated, poultry manure decomposition slower and more slowly released of own nutrients than other fertilizers, thus, the second sampling will simultaneously with highest rates of poultry manure decomposition and maximum amount of nutrient release. The third phase of fertilization was coincided with the maximum time required plant nutrients. The highest rate of fertilizer was added at this stage but due to the intense need transplanting and rapid consumption fertilizer by transplanting, the amount of nitrate accumulated of this phase is less at the first stage, but greater than the second stage. Decomposition of pigeon manure is slower than that chemical fertilizer at water saturated, therefore at the final stages of sampling a large amount of its nitrate released in treasury water. Chemical Fertilizer used in this experiment, due to rapid decomposition at water saturated, decomposing rapidly at the early stages, and its nutrient's which Most of the type of nitrate was placed at the disposal plant and with nitrate consumption by transplanting, nitrate levels at end-stage sampling was less than other stages. Pigeon manure used in this experiment were degraded faster than poultry manure and since most of its nitrogen to the ammonium form, Therefore highest rate of ammonium are chemical fertilizer and the pigeons fertilizer. Marmarin due to only 1% of ammonium nitrogen is less than others. Almost all fertilizers act unit figure at second stage but marmarin fertilizer due to having minimum nitrogen content is 1% had a minimum value of ammonium in compared other fertilizers. At this stage, due to the intense need plant for nutrients, were consumed significantly fertilizers and ammonium levels were higher than that second stage of sampling. Poultry manure Treatment at perlite media with manure because high salinity, total production transplanting was less than, **therefore** ammonium consumption was down by transplanting and so much Ammonium as not taking found at pool of this treatment. Marmarin fertilizer due to 1% nitrogen had lowest ammonium compared to other fertilizers. At pool containing pigeon manure in perlite media with manure because of high salinity levels transplanting germination percent was lower and transplanting was less productive. This led to that need transplanting is less for nutrients, especially ammonium, hence not absorbed largely than ammonium was accumulated at pool. Chemical fertilizer in perlite media with manure was much more productive transplanting and subsequently need transplanting to nutrient levels was high, thus due to high consumption of ammonium rates of ammonium were lower.

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Tables:

Table 1. Chemical analysis of water in the Tobacco Research Center, Urmia

Character	electrical conductivity (EC)	Total carbonate (HCO^-_3)	chlorides (Cl)	Bicarbonate	pH
value	6	765	65	0	7.1
Unit	$dS.m^{-1}$	MEq. L^{-1}	$Mg.L^{-1}$		

Table 2. Comparison of interaction effect between fertilizer × planting media on nitrate and ammonium amount of tobacco transplant by Tukey's metho

treatments		Nitrate				Ammonium			
		1 stage	2 stage	3 stage	4stage	1 stage	2 stage	3 stage	4stage
fertilizer	Planting media								
Chemical fertilizer	Peat media	48.8 a	20.3 cd	26.9 b	4.03 d	63.8 a	23.1 a	27.7 b	7.55 bc
	Perlite media + animal manure	29.3 ab	25.9 ab	31.7 a	5.08 d	32.6 c	23.4 a	27.4 b	5.57 c
Pigeon manure	Peat media	39.3 ab	22.4 abc	26.5 b	13.7 a	54.2 ab	23.6 a	27.2 b	11.0 b
	Perlite media + animal manure	34.8 b	23.3 abc	25.4 b	10.0 b	24.5 c	22.3 a	26.8 b	16.4 a
Poultry manure	Peat media	40.8 ab	17.1 d	25.7 b	6.80 c	31.0 c	20.5 a	23.8 b	6.10 c
	Perlite media + animal manure	36.1 b	27.3 a	31.9 a	5.58 cd	53.2 b	24.5 a	35.8 a	5.85 c
Marmarin	Peat media	15.6 c	11.1 e	12.8 d	10.7 b	25.6 c	12.0 b	12.8 c	9.95 b
	Perlite media + animal manure	19.7 c	21.5 bcd	19.7 c	9.68 b	7.8 d	9.40 b	14.7 c	6.17 c

Means followed by the same letter are not significantly different at P = 0.0