Effect of organic fertilizers on quality and quantity of tobacco transplanting in various nursery media

Laia Morad-beigi[1], Reza Amirnia[2], Mehdi Tajbakhsh[3] and RaminTagavi[4]

[1]Agriculture graduate student of Urmia University
[2]Assistant Professor of Urmia University
[3]Professor of Urmia University
[4]Expert of Urmia Tobacco Research Center

Corresponding Author: Laia Morad-beigi
Email: Laia_moradbeigi@yahoo.com
Tel: 0098-9149981655

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 carried out as factorial based on randomized complete block design (CRBD) with four replications. The first factor was disinfected poultry manure, disinfected pigeon manure and a complete fertilizer (NPK) (15-5-30) and the second factor was involved two types of media (100 percent peat and 60 percent animal manure with 40 percent perlite). The results showed that highest and lowest transplant length were obtained from chemical fertilizer treatment and poultry manure in perlite media with animal manure (11.99 mm and 3.34 mm, respectively). Compared means showed that the highest fresh weight of transplant (98.8 g) was obtained by chemical feretilizer in perlite media with animal manure which had not statistically significant different with chemical fertilizer in peat media and the lowest fresh weight of transplant (24.67 g) was obtained by poultry manure in perlite media with animal manure. the highest and the lowest dry matter of transplanting (19.72 and 8.4 g) were obtained by poultry manure in perlite media with animal manure and chemical fertilizer in peat media, respectily, which had not statistically significant different with chemical fertilizer in perlite media with animal manure.

[Laia Morad-beigi, Reza Amirnia, Mehdi Tajbakhsh and RaminTagavi. **Effect of organic fertilizers on quality and quantity of tobacco transplanting in various nursery media.** *Life Sci J* 2012;9(4):2413-2422]. (ISSN: 1097-8135). http://www.lifesciencesite.com. 358

Keywords: Floating Nursery, Organic Fertilizer, Tobacco

Introduction

Soil conditions and nutrients is very importance for Growth and development of plant. In addition to carbon, hydrogen and oxygen which supply from the atmosphere and water, macro elements including nitrogen, magnesium, phosphorus, potassium, calcium and sulfur and micronutrients are necessary for plant growth and production (Kafi 2002). In intensive farming systems, organic matter and nutrients are depleted very quickly; therefore, it is required to replace these nutrients to obtain optimum yield production. Long-term studies show that intensive use of chemical fertilizers can decrease crops yield. These reductions are occurred by soil acidification, loss of soil biological activity, reducing the physical characteristics of soil and absence of micro-nutrient into nitrogen, phosphorus and potassium chemical fertilizers (Sabahi 2006; Adediran et al. 2004). Using organic fertilizers can improve biological activities and a physicochemical property of crop growth environment. Also, organic fertilizers can neutralize or decreases the soil acidity and supply some micronutrients such as zinc, and copper. Organic fertilizers reduce the effects of drought stress by improving soil water holding capacity. In contrast, organic fertilizers have two major disadvantages include high cost of fertilizers and slow release nitrogen, especially birds manures (Hasanzade-Gourttape et al. 2000; Sabahi 2006; Adediran et al. 2004; Eghbal 2002). Short-term experiments show that in chemical fertilizers a higher percentage of nitrogen can be absorbed by plants in compared to organic fertilizers. This is due to slowly release of nitrogen in organic fertilizers (Sharifi-e-Ashourabadi 1999; Sabahi 2006; Lebasjee 2000). Long-term experiments have shown that neither the chemical fertilizer nor organic manure alone can help achieve sustainable crop production (Cooke 1997; Patra et al. 2000). But, the combined use of organic and chemical fertilizers can correct any deficit (Smith et al., 2002). Using organic fertilizers in the soil supply some of nutrients, improve soil structure, increase water storage, allowing a more appropriate preparation for root development, vegetative growth and improve quality and increase crop yield. The use of organic materials causes to reduce application of chemical fertilizers in farm fields and decrease yield differences between conventional and less consumption of agricultural inputs farming (Farzaneh 1990). Nitrogen is used in transplanting nutrition as the major element (Greer and Adam 2005). In the 90s, floating nursery technology was used due to reduce greenhouse costs in Virginia State. This method is used in Iran to produce Burley 21 and Coker 319tobacco transplant since 2002. Reducing labor costs, lack of weed seeds in planted media, high quality and uniformity of transplanting, impossibility of contamination of groundwater with nutrient leaching and control of environmental conditions and increasing water use efficiency, is including the benefits of these Nurseries (Poisson and Francois 2008; Rideout 2004). Transplant nutrition is done through the injection of soluble and liquid fertilizers in water of irrigation systems. Nitrogen is the most important element that is used in transplanting nutrition. Water-soluble nitrogen sources for this purpose are including: fish meal, fish emulsion, earthworms, bats manure and seabirds manure (Greer and Adam 2005). By using organic fertilizers, it is not expected that plants respond immediately and similar to what is seen on chemical fertilizers in the first two days. Ammonium form can be used directly by plants; especially in high levels of light, but usually most of the nitrogen is absorbed in the nitrate form (Agro 1998). The effect of seasonal changes in growth of transplant is important point which should be considered in the fertilization program. For example, tomato transplants produced in spring showed linear growth with increasing nitrogen fertilizer, while there was opposite situation in production of transplants in the autumn and this problem can be related to light and temperature conditions of autumn compared to spring (Smith and Spears 2003). In the other study, floating nursery showed that transplants produced with manure of seabirds were smaller than controls, but transferable transplants were same as control (Rideout 2004). In year 2000, commercial organic fertilizers were compared with a complete fertilizer in the production of lettuce and concluded that the use of commercial organic fertilizers can be produced lettuce in the floating nursery and there was no difference with a complete fertilizer and organic fertilizer in lettuce production (Anderson and Stephanie 2000). Smith and fisher (2002) showed that seabird manure has a positive effect on the transplant growth and percentage of usable transplant (Smith and Spears 2003). Tobacco (*Nicotiana tabacum* L.) is one of the industrial plants of *Solanaceae* family and *Nicotiana* Genus With 2n = 48. Tobacco with conventional name N. tabacum along with N. rustica is two species of six species of tobacco which are created several types of recognized tobacco (Koujaci and Nasiri-Mahalati 1994). Tobacco is a perennial plant, but usually is grown as an annual, because it cannot tolerate cold and frost conditions. Tobacco is a short day plant, but there is a day-neutral and long-day variety (Koujaki and Nasiri-Mahalati 1994).

Material and Methods

The research was performed in Urmia Tobacco Research Center, located in North of Urmia City (37° 40.2′ N and 45° 2.2′ E) in 2010. Based on Urmia Synoptic Meteorological Station reports, average annual rainfall and temperature are 309.4 mm and 12.7° C in 2010. The experiment was carried out as factorial based on randomized complete block design (RCBD) with four replications. The first factor was three levels of fertilizers including: disinfected poultry manure, disinfected Pigeon manure, a complete fertilizer (15-5-30) and the second factor was involved two types of media (100 percent peat and 60 percent animal manure with 40 percent perlite). In this experiment, we used pools of water to a height of 12 cm, length 60 cm and width 44 cm. 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. Black plastic should be 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 is water quality of floating nursery, especially in the greenhouse floating nursery. Water quality used in this experiment was evaluated and the amount of bicarbonate, chloride, electrical conductivity and pH was determined. 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 considered 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, we used Gromor manure added 750 g/m3in two steps to nursery water with formula fertilizer (30-5-15) (N-P-K). At first phase fertigation was 665 g/m^3 of water media that correct amount fertilizer according to 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/m3 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/m3 of water media.

Measuring of characteristic

During the experiment, the start time of germination, percentage of germination, transplant stem diameter, height, fresh and dry weight, percentage of transplant dry matter (woody criteria of transplant) at the time of transplanting, the percentage of usable seedlings (transferable to the main land) and the concentration of phosphorus, nitrogen, potassium and sodium were measured in 10 randomly selected transplant. To measure dry weight, transplants were placed into the autoclave at a temperature of 50 ° C for 8 hours. Total number of transplant and usable transplant were counted systemically in each tray.

Phosphorus measurement

To measure phosphorus we used the Spectrophotometer model PD-303. A similar method was used for measuring phosphorus in pond water and into plant tissue. To measure the amount of phosphorus in the pond, we used directly the extract in the ponds, but for the plant tissue, first transplants were converted to extract form by digestion method in way dry burn and combined with hydrochloric acid.

Measuring total nitrogen by titration method after distillation with the use of automatic system (Kegel single auto-analyzer):

This measuring is carried out for extracts produced from the above method by digested in volumetric flask with sulfuric acid - acetylsalicylic acid - hydrogen peroxide.

Potassium measurement

For measuring of potassium Flame photometer Clinical PFP7 model was used. In this method a similar method for measuring phosphorus in pond water and into plant tissue was used. Only with this difference that to measure the amount of phosphorus in the pond, we used directly the extract in the ponds, but for the plant tissue, first transplants were converted to extract form by digestion method in way dry burn and combined with hydrochloric acid.

Micro-nutrients measurement by Atomic Absorption Spectroscopy (AAS) method

Iron, Zinc and Cupper elements measuring in extracts were done by atomic absorption by digestion method to through a dry burning way with the use of HCl. Standard, control and extract samples are clouding with a blue air-acetylene flame and measuring the absorption of iron, zinc and copper at wave lengths 248.3, 213.9 and 324.7 nm, respectively, and obtain the concentrations of iron, zinc and copper sample with the use of concentration readout devices systems or with the use of calibration curve. Amounts of each desired element from dried plant samples in mg per kilogram are obtained by to following way.

$$(a-b)\times\frac{v}{w}\times\frac{100}{DM}$$

Where: a is element concentration in milligrams per liter of sample, b: Element concentration in milligrams per liter of control, V: Volume of extract per ml of digestion, W: sample weight plant in gram and DM: Plant dry matter percentage.

Statistical analysis was performed using by SAS and MSTATC statistical software.

Result and discussion

Morphological characteristic

The results of analysis of variance showed that the effect of fertilizer on length, diameter, root length, dry weight and percent dry matter of transplant was significant at 1% probability level and on fresh weight was significant at the 5% probability level but was not significant on germination percentage. While the effects of plant media on germination percentage, length and root length of transplant was significant at 1% probability level, but was insignificant on the diameter, fresh weight, dry weight and percent dry matter of transplant. The interaction effects between fertilizer and planting media for length, fresh weight and dry matter of transplant was significant at 1% probability level, but was insignificant on germination percentage, diameter, root length and dry weight of transplant (Table 2).

Germination percentage

The effect of fertilizer and interaction effect of fertilizer with planting media on germination percentage were non-significant, but the effect of planting media was significant at 1% probability level; and peat media were accounted the highest (79.5%) and the perlite media with manure had lowest (71.3%) germination (table 3).

Transplant Height

Fertilizer and planting media interaction was significant on length transplant character. Chemical fertilizer in peat media and poultry manure in perlite media was accounted highest (11.99 mm) and lowest (3.34 mm) length transplant, respectively (Table 4).

Transplants Diameter

Analysis of variance showed that interaction of the planting media and fertilizer on transplant diameter was non-significant, but the effect of fertilizer was significant on transplant diameter at 1% level, which maximum diameter (7.15 mm) and minimum diameter (4.7 mm) transplant were obtained from chemical fertilizer and pigeon manure treatments that was no statistically significant difference with poultry manure (Table 3).

Root length

Mean comparison of fertilizer effect showed that the highest (137.23 mm) and the lowest (10.70 mm) root lengths were obtained from chemical fertilizer and pigeon manure treatments, respectively. The main effect comparison of planting media showed that the highest root length (70.05 mm) were obtained from peat media and the lowest root length (64 mm) were obtained from the perlite media with manure (Table 3).

Transplant fresh weight

Comparison of means indicated that the highest fresh weight of transplant (98.98 g) was obtained by chemical fertilizer treatment on the perlite media with manure that was not statistically significant difference with chemical fertilizer treatment on peat media and the lowest fresh weight of transplanting (24.67 grams) was obtained from poultry manure in perlite media treated with animal manure (Table 4).

Dry weight of transplanting

Comparison of means showed that the highest transplant dry weight (8.63 g) was obtained from chemical fertilizer treatments and the lowest transplant dry weight (5.54 g) was from poultry manure which is not significant difference with pigeon's manure treatment (Table 4).

Percentage of transplant dry matter

Comparison of means showed that the highest percentage of transplant dry matter (19.720) was obtained from poultry manure in the perlite media with manure and the lowest percentage of transplant dry matter (8.40) was produced from chemical fertilizer in peat media, which does not significant difference with chemical fertilizer in perlite media with manure (Tabel 3).

Macro-Nutrient elements value

The results of analysis of variance showed that the main effect of fertilizer was significant on nitrogen, phosphorus and potassium percentage at the 1% probability level. The main effect of planting media on nitrogen percentage was not significant, but was significant on phosphorous and potassium percentage at the 1% probability level. In addition, the interaction effect of fertilizer and planting media was significant on nitrogen and potassium percentage at the 1% probability level, but it was significant on phosphorus percent at the 5% probability (Table 2).

Nitrogen

The results of comparison of combined treatment means between fertilizers and planting media showed that the highest percentage of nitrogen (4.74) was obtained from chemical fertilizer at peat media, which had no statistically significant difference with chemical fertilizer at perlite media with manure. The minimum N percentage (1.78) was resulted from the pigeons manure at peat media, which there was no statistically significant difference with pigeon manure at perlite media with manure (Table 4).

Phosphorus

Comparison of data means showed that the highest level of phosphorus (0.158) was from chemical fertilizer treated in peat media that had no statistically significant difference with chemical fertilizer in perlite media with manure and the lowest level (0.083) was from poultry manure in perlite media with animal manure (Table 4).

Potassium

The results of compare means showed that the highest amount of potassium (2.162) was from chemical fertilizer in peat media that had no statistically significant difference with chemical fertilizer treatments in perlite media with animal manure (Table 4).

Micronutrient elements value

The results of analysis of variance showed that the main effect of fertilizers were significant on iron, zinc and copper levels in 1% and sodium percentage at the 5% probability level. The main effect of planting media was significant on the iron and copper levels at 1% level, but was not significant on the amount of zinc and sodium elements. Interaction effect between fertilizer and planting media were significant on the amount of iron, zinc and copper at 1% probability level.

Sodium

The result of compare means showed that the highest amount of sodium (0.186) was from pigeon manure treatment and the lowest amount of sodium was achieved (0.170) by poultry manure that had no significant difference with chemical fertilizer treatments (Table 3).

Iron

Comparison of data means showed that the highest and lowest rate of iron (263.687 and 49.076 mg kg dry matter) was obtained from chemical fertilizer treatment in perlite media with animal manure and was from treated poultry manure in peat media, respectively (Table 4).

Zinc

Comparison of data means showed that the highest rate of zinc (51.45 mg kg dry matter) was from poultry manure in perlite media with animal manure which was not statistically significant difference with chemical fertilizer in peat media and the lowest rate of zinc (15.62 mg kg dry matter) was obtained from pigeon manure in perlite media with animal manure (Table 4).

Copper

The result of compare means showed that highest rate of copper (10.92 mg kg dry matters) was obtained from pigeon manure treatment in peat media and the lowest (3.57 mg kg dry matter) from poultry manure in peat media(Table 4).

Discussion

Morphological characters

Decrease in germination percentage at perlite media with manure in this research may be result of a high level of EC in the perlite media with manure (Table 3). Smith and Fisher (2001) obtained the highest germination percentage with peat media in the float nursery. Because of existence two types of manure together, manure in the planting media and existence poultry manure, salinity was higher than standard value and actually produced less transplant with lower growth. Smith et al (2002 and 2003) achieved maximum length of transplant by chemical fertilizer treatments. Chemical fertilizers are completely soluble in water rather than organic fertilizers and they provide chelated micronutrients for plants and finally cause improving vegetative growing conditions. Also, Rideout and Gooden (2002) and Smith et al (2002 and 2003) obtained maximum diameter of transplanting by chemical fertilizer treatments. Fortnum et al (2000) and Smith et al (2002 and 2003) obtained the highest root length from chemical fertilizer treatments. Rapid decomposition of chemical fertilizer in water rather than other organic fertilizers causes nutrients be available faster for transplanting and in the chemical fertilizer treatments increase fresh weight (Table 4). In the investigation of fertilizers in the floating nursery system, Smith et al (2001and 2002) obtained the highest weight of transplant by chemical fertilizer treatments. Chemical fertilizers supply micronutrients as chelate to transplanting, therefore, produced transplants are larger and better than transplants are produced by the other fertilizer treatments and had more dry weight than any other transplant after drying. Smith et al (2001) in the investigation of fertilizer types on tobacco transplanting in the floating nursery system indicated that the highest dry weight of transplanting obtain by chemical fertilizer treatments. Due to low germination percentage, transplant existing in perlite media with manure had enough space, light and air that it caused increasing flow of air in transplant canopy and finally, percentage of dry matter was increased. Smith et al (2001) obtained the highest percentage of dry matter of transplant by bats organic fertilizer treatments.

Macro-nutrients

Most part of nitrogen in pigeon manure was as ammonium form of fertilizer and due to increasing water temperature in the hot times of day, it could be evaporate in ammonia form, which has been a cause of less absorption of nitrogen in pigeon manure. Available nitrogen was as nitrate ions at chemical fertilizers and has been absorbed completely by plants; therefore, transplant nitrogen concentration was in standard level in using chemical fertilizer. Zublena et al (1986) and Smith et al (2001) obtained the highest percentage of nitrogen from chemical fertilizer treatments in peat media. High level of absorbable phosphorus can be because of its high level in fertilizers (Table 4). In poultry manure treatment in perlite media with animal manure, despite high concentrations of phosphorus, plants do not easily absorb it, while the pigeon manure decomposes enough and phosphorus content of pigeon manure has been in absorbable form for transplanting. Zublena et al (1986) and Smith et al (2001) obtained the highest percentage of phosphorus from chemical fertilizer treatments in peat media. A Part of the plant potassium requirements is supplied through the animal manure contained in planting media, while purified peat has been free of the plant available potassium (Table 4). Zublena et al (1986) and Smith et al (2001) obtained the highest percentage of potassium from chemical fertilizer treatments in peat media.

Micro-nutrients

Pigeon manure degrades faster than poultry manure in water and more quickly absorb by transplanting. Poultry manure in water saturation, release its nutrients more slowly therefore, the transplanting will have less sodium. Smith et al (2001) obtained the highest percentage of sodium in bat organic manure. Since a part of plant iron requirement has supplied from the animal manure available in planting media, therefore, the highest rate of iron was in this treatment (Table 4). Smith et al (2001) and Anderson et al (2000) obtained highest rate of iron from chemical fertilizer in perlite media with animal manure. Due to rapid decomposition of chemical fertilizer in water saturation, microelements such as a large amount of zinc supply to plants it. Plants get some of its requirements to zinc elements from animal manure available in planting media. According to this, there was the highest rate of zinc at poultry manure treatment in perlite media with animal manure. Zublena et al (1986) obtained the highest rate of zinc by poultry manure in perlite media with animal manure. Pigeon manure decomposes more than poultry manure in water saturation and copper content on pigeon manure is higher than other fertilizers. Smith et al (2001) and Anderson et al (2000) obtained highest rate of the copper from poultry manure in perlite media with animal manure.

Reference

Adediran JA, Taiwo LB, Sobulo RA, Idowu OJ (2004) Application of organic and inorganic fertilizer for sustainable maize and cowpea yields in Nigeria. Journal of Plant Nutrition, 27: 1163-1181.

Agro ZR (1998) Root medium chemical properties: Hort. Technology. 8: 486-494.

Anderson RG, Stephanie L (2000) Nutrient analysis of selected commercial organic fertilizers for lettuce production. Hortfact: 16-20.

Cooke GW (1997) the roles of organic manures and organic matter in managing soils for higher crop yield. A review of the experimental evidence. Page 53-64 in the proceeding of the international seminar on soil environment and fertility management in intensive agriculture. The Society of the Science of soil and Manure, Japan (Nippon Dojyohiryo Gakkai), Tokyo.

Eghbal B (2002) Soil properties as influenced by phosphorus- and nitrogen-based manure and compost applications. Agronomy Journal, 94: 128-135.

Eghbal B, Wienhold B, Gilley J (2001) Intensive manure management for improved nutrient and environment quality. Soil and Water Conservation Research, 1: 128-135.

Eltun R, Korsaeth A, Norndheim O (2002) A comparison of environmental, soil fertility, yield and economical effects in six cropping cling Environment, 90: 155-168.

Farzaneh H (1999) Agro-Chemical (Translated). Avaei- Nour press (In Persian).

Fortnum BA, Rideout J, Martin SB, Gooden D (1997) Nutrient solution temperature affects Pythium root rot of tobacco in greenhouse float systems. Plant Disease/ Vol. 84 No.3, publication no D-2000-0120-02R, The American phyto-pathological Society: 286-294.

Ginting D, Moncrief JF, Gupta SC, Evans SD (1998) Interaction between manure and tillage system on phosphorus uptake and runoff losses. Journal of Environment Quality, 27: 1403-1410.

Greer L, Adam L (2005) Plug and transplant to nitrate phosphate conditioning: effects on development, growth and early yield. Acta Horticulture 609: 213-217.

Hasanzadeh-Gourttape A, Galavand A, Ahmadi MR, Mirnia SKh (2000) Effetc of organic, chemical and Integrated fertilizers on quality and quantities yield of sunflower (Helianthus annuus L.) in Western Azerbaijan. Agriculture Science. 6(2): 85-140 (In Persian).

Kafi M (2002) Cumin, Technology, production and processing. Center of Excellence for Special Crops. Ferdowsi University OF Mashhad Press: 19-33 (In Persian).

Koujaki A, Nasiri-Mahalati M (1994) Ecologiy of crops plants. Ferdowsi University OF Mashhad Press. 152p. (In Persian).

Lebasjii MH (2000) Study aspects of Eco-physiology of in Hypericum flowers in natural and agronomy ecosystems. Ph. Thesis. Tarbiat Modares University. 140 pp. (In Persian).

Patra DD, Anwar M, Chand S (2000) Integrated nutrient management and wast recycling for restoring soil fertility and productivity in Japanese mint and mustard sequence in Uttar Pradesh, India. Agriculture Ecosystem & Environment, 80: 267-275.

Pearce RC, Zhan Y, Coyne MS (1998) Nitrogen transformation in the tobacco Float system. Tobacco Science, 42:82-88.

Poisson C, Francois N (2008) Evaluation of tobaccos grown under organic cultural practices. CORESTA Congress, Shanghai, 2008, Plenary Session, Abstr. IG01.

Rideout JW (2004) Field growth and yield of tomato transplant, growth in the float system using low phosphorus fertilizer and height restricting cultural practices, Hort. Sci. 39 (1): 23-27.

Rideout JW, Gooden DT (2000) Effects of starts fertilizer, granular phosphorus fertilizer, time of fertilization and seedling phosphorus concentration. Tobacco Science. 44:19-26.

Sabahi H (2006) Effect of integrated organic and chemical fertilizers application on biological activity, soil physicochemical characters and canola yield on Zir-Ab region (Sari). Ph. Thesis. Tarbiat Modares University. (In Persian).

Sharifi – e – Ashourabadi A (1999) Study soil fertility in agronomy ecosystems. Ph. Thesis. Islamic Azad University Science and Research Branch. 248 pp (In Persian).

Smith WD, Spears F (2003) Transplant production with the float system, In burley tobacco information 2003. North Carolina Cooperative Extension Service. North.

Smith WD, Fisher LR, Spear F (2002) Transplant production with the float system. In Burley tobacco information: North Carolina State University.

Zublena JP, Barid JV, Lilly JP (1991) Nutrient content of fertilizer and organic materials. SoilFacts. AG-439-18.

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. ANOVA of morphological traits on Burley 21different transplanting affected by types of fertilizers and planting medias in floating nursery system

ANOVA	Mean square							
	df	GP	TL	DT	RL	FWT	DWT	DMT
Replication	3	0.033 ns	0.029 ns	0.32 ns	2.24 ns	4.58 ns	0.01 ns	1.19 ns
Fertilizer	2	0.012 ns	86.59**	14.99**	33177.8**	9280.9**	19.66**	160.5 **
Planting media	1	1.94**	10.67**	0.004 ns	219.31**	3.56 ns	1.70 ns	4.69 ns
F × P.B	2	0.004 ns	6.31**	0.046 ns	37.31 ns	268.99**	0.60 ns	18.45**
Error	15	0.053	0.12	0.27	13.64	6.50	0.41	1.32
CV (%)	-	2.65	5.13	9.34	5.51	4.40	9.28	8.35

ns, * and **, non-significant and significant at 5% and 1% probability level.
GP: Germination percentage, TL: Transplant length, DT: Diameter transplant, RL: Root length, FWT: Fresh weight of transplant, DWT: Dry weight of transplant and DMT: Dry matter of transplant.

Table 3. ANOVA of macro and micro nutrient on Burley 21different transplanting affected by types of fertilizers and planting medias in floating nursery system

ANOVA	Mean square							
	df	N	P	K	Na	Fe	Zn	Cu
Replication	3	0.02 ns	0.0002 ns	0.007 ns	0.0007*	100.26 ns	9.16 ns	1.44 ns
Fertilizer	2	15.9**	0.007**	2.04**	0.0007*	14619.9**	1110.7**	25.42**
Planting media	1	0.06 ns	0.001**	0.82**	0.00006 ns	92468.1**	38.9 ns	25.81**
F × P.B	2	0.24**	0.0003*	0.52**	0.0003 ns	1435.2**	629.5**	28.83**
Error	15	5.11	0.0001	0.01	0.0001	52.05	10.87	0.92
CV (%)	-		7.98	8.8	7.7	4.62	9.69	15.44

ns, * and **, non-significant and significant at 5% and 1% probability level.

Table 4. Comparison of main effect between fertilizer × planting media on studied traits of tobacco transplant by Tukey's method

treatments	Compared means				
	Germination (%)	DT (mm)	RL (mm)	DM (G)	Na (%)
fertilizer					
Chemical fertilizer	-	7.15 a	10.7 c	8.63 a	0.162 b
Pigeon manure	-	4.75 b	53.1 b	6.60 b	0.183 a
Poultry manure	-	4.80 b	137.2 a	5.54 b	0.168 b
Planting media					
Peat media	79.5 a	-	70.1 a	-	-
Perlite media + animal manure	71.3 b	-	64.0 b	-	-

Means followed by the same letter are not significantly different at P = 0.05.

Table 5. Comparison of interaction effect between fertilizer × planting media on studied traits of tobacco transplant by Tukey's method

treatments		TL (mm)	FWT (g)	DMT (%)	N (%)	P (%)	K (%)	Fe (mg.Kg-1 DM)	Zn (mg.Kg-1 DM)	Cu (mg.Kg-1 DM)
fertilizer	Planting media									
Chemical fertilizer	Peat media	12 a	98.7 a	8.40 c	4.74 a	0.16 a	2.16 a	109.7 d	46.59 a	7.28 b
	Perlite media + animal manure	9 b	94.0 a	9.52 c	4.50 a	0.16 a	2.01 ab	263.7 a	31.19 b	5.39 bc
Pigeon manure	Peat media	6 c	38.8 c	15.8 b	1.78 c	0.14 ab	0.78 d	123.3 d	25.56 b	10.92 a
	Perlite media + animal manure	6 c	52.9 b	13.5 b	1.90 c	0.12 bc	1.65 bc	225.4 b	15.62 c	4.97 bc
Poultry manure	Peat media	5 c	35.0 cd	15.9 b	3.39 b	0.11 cd	1.01 d	49.07 e	33.75 b	3.57 c
	Perlite media + animal manure	3 d	28.0 d	19.7 a	3.83 b	0.08 d	1.39 c	165.8 a	51.45 a	5.20 bc

Means followed by the same letter are not significantly different at P = 0.05.