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The Effect of Nitrogen and Potassium Fertilizers on Yield of Flue-Cured Tobacco cv.Coker347 in Iran

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Abstract. In order to investigate the effect of nitrogen and potassium fertilizers on yield of flue-cured tobacco cv.Coker347, 2 years experiment was carried out in Tobacco Research Institute of Rasht city located in Guilan province on factorial based using a factorial experiment with 8 treatments and 3 replications. The applied fertilizer levels included 35(N1), 45(N2), 55(N3) and 65(N4) Kg N/ha as urea source and potassium in two levels of 150(K1) and 200(K2) Kg K/ha potassium as potassium sulphate source. The measured parameters in this experiment included dry leaf yield, stem height, stem diameter, leaves number, leaf length, leaf width, stem dry weight, biomass, flowering, nicotine and sugar content. levels of 65 Kg N/ha and 200 Kg K/ha had the highest amount of dry leaf yield. The greatest number of leaves and leaf length were associated with using 55 Kg N/ha and 200 Kg K/ha as well as using 65 Kg N/ha and 200 Kg K/ha. Applying 65 Kg N/ha and 200 Kg K/ha, 55 Kg N/ha and 150 Kg K/ha indicated the highest amount of biomass.

Key words: Nitrogen, Potassium, Yield, Flue-Cured Tobacco

1. Introduction

In comparison with other plants, tobacco is counted among rather new crop and after its discovery in Central America, smoking became widely prevalent all around the world. Despite the unpopularity of smoking among people of the world, tobacco is still one of the valuable industrial and agricultural products. Tobacco has key role on economy of producer countries and the revenue earned from this industry is an important part of the national income. Every day, millions of people are occupied directly or indirectly in cultivation, production industry and transaction of tobacco all around the world (8).

Generally tobacco quality would be determined by type and amounts of elements in existent compounds of tobacco as well as relations and interactions between them. These chemical determine the economical and hygienic importance of tobacco and its different productions. Evaluation of leaf quality depends on relative concentration of various organic compounds such as total alkaloids and reductive sugars (1). Nitrogen is one of the basic growth elements and directly impacts on tobacco growth and development (5). Nitrogen is a basic part of most compounds existed in tobacco. The balanced content of nitrogen leads to an increase in crop yield and does not have undesirable effect on tobacco quality. Although an excessive amount of nitrogen increases the crop yield to some extent, too much nitrogen compounds have negative influence on tobacco quality. Studies indicate that nitrogen fertilizer consumption increases crop production and nitrogen compounds but using excessively not only does not have any significant effect on yield but also decreases the quality. Some reports state that nitrogen usage affects on tobacco nitrate amounts (6).

Potassium in proper amount is not only is useful for growth but also necessary for tobacco quality. More potassium content leads to its bonding with organic acids and better tobacco burning quality (8). Potassium is even able to neutralize the negative effects of some elements like chloride in tobacco burning quality. It seems as though potassium is an important element in formation of starch and sugar in tobacco. Excessive amount of potassium and sugar in tobacco is usually fermented and consequently leads to better tobacco quality. During burning, potassium minerals especially potassium organic salts swell and cause better and more complete oxidation. Potassium is one of the effective factors in better burning of tobacco (3).

The objective of this study was to investing the nitrogen and potassium fertilizers effect on yield of flue-cured tobacco cv.Coker347.

2. Materials and Methods

A two year experiment conducted in 2008-2009 with 35(N1), 45(N2), 55(N3), 65(N4) Kg N/ha^{-1} from urea source and 150(K1), 200(K2) kg K/ha potassium from potassium sulphate source regarding common condition of region and experts advice using a factorial experiment with 8 treatments and 3 replications at Tobacco Research Institute of Rasht city located in Guilan province (Iran) at longitude 49˚3´east and latitude 37˚ 16´ north and 25 altitude from sea level. 50 % of determined fertilizer level for each plot was applied before sowing and transplanting. Irrigation time was determined using a tensiometer based on suction power of 40-50 cm bar. Weeding control was performed twice. 50 % of remained fertilizer level was applied on two bands (The distance between bands was 10 cm) in 10 cm depth of soil. Studied parameters in this article were: dry leaf yield, stem dry weight, stem height, stem diameter, biomass, leaves number, leaf length, leaf width, flowering period, nicotine and sugar content. At industrial ripening, leaves are harvested through 4 picks. The harvested leaves at every picks are first measured after carrying to saloon and the green leaves weight were recorded. Afterwards, the leaves were separately setup at the petiole over the cassettes and transferred to the balkguring hot–house for drying. The leaves passed three steps of giving color, fixation and drying. The harvested stems were conveyed to the hot-house for three days for drying and then their weight was measured. The plant leaf number was recorded by counting of leaves. Leaf length was measured from initiation of petiole to the tip of leaf by ruler. The widest part of leaf was considered as a leaf width and measured. The number of days from transplanting until reaching 50% of flowering was recorded as flowering time. The auto analyzer set was used for measuring sugar and nicotine content and the measurement method was based on pourin loop or siyanozhen formation. For measurement of reductive sugar percentage, the yellow color of ciyanid feric was used. The weakening of color depends on the amount of reductive sugars existed in extract which is measurable in chlorimeter set.

Variance analysis and mean comparisons were done by SAS software.

3. Result and Discussion

Applying levels of 65 Kg N/ha and 200 Kg K/ha produced the highest amount of dry leaf yield with average weight of 2093.8 Kg/ha. Levels of 55 Kg N/ha plus 200 Kg K/ha with average weight of 1937.2 Kg/ha dry leaf yield, Levels of 55 Kg N/ha plus 150 Kg K/ha with average weight of 1747.80 Kg/ha dry leaf yield and Levels of 45 Kg N/ha plus 150 Kg K/ha with average weight of 1559.8 Kg/ha dry leaf yield stand in the second to the fourth classes. Levels of 45 Kg N/ha plus 200 Kg K/ha and 35 Kg N/ha plus 200 Kg K/ha with average weight of 1509.5 and 1494 Kg/ha dry leaf yield respectively were in the fifth class. Levels of 65 Kg N/ha plus 150 Kg K/ha with average weight of 1304.5 Kg/ha dry leaf yield and Levels of 35 Kg N/ha plus 150 Kg K/ha with average weight of 1255.8 Kg/ha dry leaf yield were in the same class and caused the minimum amount of dry leaf yield.

Levels of 55 Kg N/ha plus 200 Kg K/ha as well as Levels of 65 Kg N/ha plus 200 Kg K/ha led to the highest leaves number with average number of 30.39 and 30.36 leaves respectively. Applying 55 Kg N/ha plus 150 Kg K/ha and 45 Kg N/ha plus 150 Kg K/ha caused average number of 28.93 and 26.33 leaves stand in the second and third classes respectively. Level of 65 Kg N/ha plus 150 Kg K/ha was in the fifth class for leaves number (average number of 24.91 leaves). The least leaves number (22.57 leaves) belonged to usage of 35 Kg N/ha plus 150 Kg K/ha. Applying levels of 65 Kg N/ha plus 200 Kg K/ha (46.82 cm), 55 Kg N/ha plus 200 Kg K/ha (46.13 cm) led to the highest leaf length. The levels of 55 Kg N/ha plus 150 Kg K/ha and 45 Kg N/ha plus 200 Kg K/ha which led to average leaf length of 44.70 and 44.86 cm respectively were both in the second class. The fertilizer levels of 45 Kg N/ha plus 150 Kg K/ha in which the average leaf length of 44.73 cm was appeared, stood in the third class. Likewise, the level of 35 Kg N/ha plus 200 Kg K/ha leaf length of 43.68 cm was in the fourth class. The levels of 65 Kg N/ha plus 150 Kg K/ha ranked in the fifth class. The least leaf length (the average length of 38.37 cm) was related to the levels of 35 Kg N/ha plus 150 Kg K/ha. The greatest amount of biomass with average weight of 3342.2, 3265.7 and 3037.5 kg/ha were belonged to fertilizer levels of 65 Kg N/ha plus 200 Kg K/ha, leaves of 55 Kg N/ha plus 200 Kg K/ha and 55 Kg N/ha plus 150 Kg K/ha respectively. The fertilizer levels of 45 Kg N/ha plus 200 Kg K/ha, 35 Kg N/ha plus 200 Kg K/ha, 45 Kg N/ha plus 150 Kg K/ha, 65 Kg N/ha plus 150 Kg K/ha and 35 Kg N/ha plus 150 Kg K/ha in which the average biomass amounts included 2661.5, 24.207, 2384.8, 2150.3 and 2025.2 Kg/ha respectively, were all ranked in the second class.

Nitrogen had specific importance among microelements. Tobacco is able to absorb nitrate ions easily and preserve them in leaves. In root cells, nitrate ions are changed into other compounds or transferred inside the xylems and then conveyed towards other organs. Soil temperature and acidity and the type of utilized nitrogen are contributed to the nitrogen absorption by plant. Plant nitrogen depends on nitrogen mobility in soil, and its absorption and transference in plant (7). Nitrogen is a necessary element for composing amino acids, amids, proteins, nucleic acids, nucleotides, coenzymes, hexoamins, etc (2). If plants are sown in an area which nitrogen is a restrictive growth element, plants will have lots of developed roots growth but their upper organs don't grow very well. Conversely the plants which grow in nitrogen-enriched area produce abundant branches and leaves but their roots don't grow very well. Adding more nitrogen causes less increase than previous time until adding more nitrogen will not have any effect on root weight increase. If more nitrogen is added after this time, the roots will be decayed. As a result, adding the average quantity of nitrogen will have desirable effect on root evolution and using this amount of nitrogen as better than disuse of it (7). Potassium is very important in ionic equilibrium, penetration potential of cellular membrane and glucosid circulation. Potassium deficiency results in necrosis or death of green leaves cells. By gradually reduction of potassium, concentration of malic acid decreases and citric acid amount increases (6). In plants with enough leaf potassium content, the energy use efficiency would be 50-70% more than plants with low leaf potassium content. This effect is probably due to potassium role in adenosine three phosphates (ATP) synthesis which is the main compound in conserve and transmission of energy. Potassium has also great impact on osmotic and turgor pressure adjustment via increase of cell size (3). It is obvious that different component reactions which are activated by potassium have positive effect on crop quantity and also on production of materials like sugar, starch, protein, cellulose and vitamins that increase plant quality. In addition, potassium has indirect effect on increase of crop production by increasing of plant resistance to pests and diseases. Increase of pant resistance to pests is due to improvement of cellular wall and also decrease in soluble materials in plants (4). The plants reactions to potassium absorption mostly depend on nitrogen nutrition level. Generally, the more plant enjoys nitrogen, the more crop yield will be expected due to more potassium.

Table 1: Comparison of Average Interaction Effect of Nitrogen and Potassium Fertilizers for the Studied Qualities

Treatments	Dry Leaf Yield	Leaf Number	Leaf Length	Biomass
N35K150	1255.8f	22.58d	38.37d	2025.2b
N35K200	1494.0de	25.75c	42.75c	2402.7b
N45K150	1559.8cd	26.33bc	43.69abc	2384.8b
N45K200	1509.5de	25.99c	44.69ab	2461.5b
N55K150	1747.8bc	28.93ab	44.73ab	3037.5a
N55K200	1937.2ab	30.39a	46.13ab	3265.7a
N65K150	1304.5ef	24.91cd	40.80cd	2150.3b
N65K200	2093.8a	2093.8a	46.82a	3342.2a

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