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Study nitrogen uptake changes in growth stages of Tobacco (Nicotiana tabaccum)

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ABSTRACT: Nitrogen is primary element that is absorbed relatively early in plant's life. It is most important element that affects the growth and development of tobacco plant and the quality of leaf tobacco. This study was performed in order to understand more nitrogen uptake changes between varieties of tobacco, six varieties of tobacco were examined, DRVI, DRV10, Madole, Kentucky 171, Toleza 68 and Western for absorption and accumulation determination nitrogen in different plant parts at stages of growth, and quality characteristics. Plants were grown in a unheated greenhouse in March, and then seedling transplanted into the field in spring, and in a randomized complete block design (RCBD) was planted with four blocks in field of Tirtash Tobacco Research Institute. Results showed that there were significant differences between different cultivars in percentage of root nitrogen, leaf nitrogen and percentage of sugar. But percentage of stem nitrogen, nicotine, total ash and burning time were not different between varieties. Amount of nitrogen in different plant parts varieties were different at different stages of growth. The maximum and minimum absorption of nitrogen was observed at early and late stages of growth (42-58 and 94-122 days after planting), respectively.

***Keywords*:** Tobacco, Nicotine, Sugar, Nitrogen, Growth stages.

INTRODUCTION

Tobacco is the most widely grown commercial nonfood crop in the world. The quality and chemical properties of leaf tobacco cultivars are influenced by genetics, agricultural practices, soil type, nutrition absorption and etc (13, 16). Assessment of leaf quality depends primarily on the relative concentration of various organic constituents and inorganic constituents (13). Practical application of plant analysis as a diagnostic tool rests essentially on the assumption that a rapid and positive relationship exists between soil nutrient supplies within the root zone and the concentration of those nutrients in the plant (1, 10, and 13). Nitrogen affects the grown of tobacco than any other nutrient. Amount of nitrogen in different plant parts varieties are different at stage of growth. The uptake nitrogen is very high during the early stages of growth and diminishes from about topping onwards, when release from mineral reserves balances uptake (4, 6, 7, and 13). Sreeramamurty and Gopalachari (15) reported that a gradual reduction in the percent nitrogen with age of the plant from 30th day to 120th day. Goenaga et al (6) studied uptake of nitrogen by flue-cured tobacco that about 80% of total nitrogen in tissues of plant had been taken up during the first weeks after transplanting that exhibiting rapid growth rates of plant parts, environmental conditions and hence high sink capacities for nitrogen. Evanylo et al (5) reported that nutrition absorption were influence plant genetic, weather and fertilization. Raper and Mc cants (12) found relative growth rates and relative accumulation rates of nitrogen a flue-cured cultivars in phytotrons were unaffected by temperature and nutrient supply. Bruns and Mcintosh (1) reported that differences among flue-cured, burly and cigar wrapper tobaccos may reflect cultural, genetic distinctions, and management practices. The objective of this work was study of nitrogen uptake changes tobacco (Nicotine tabaccum).

Materials and methods:

Varieties of tobacco (DRV_1, DRV_{10}, Madole, kentuckey 171, Toleza 68 and western) were planted in field of Tirtash Tobacco Research Institute on sandy-loam soil. Cultural praxes were optimum for leaf production and same for all cultivars. Fertilizer application was at the rate of 52 kg N hac^{-1}, 96 kg p_2o_5 hac^{-1} and 185 kg k_2o hac^{-1}. The experimental design was a randomized block with four replication and plot size 40 m^2. Tobaccos were manually topped at the early flowering stage above 20th leaf and the wound treated with a maleic hydrizied, 15 $^{lit}/_{hac}$ to prevent lateral sucker growth. During the growing period (42, 58, 94 and 122 days after transplanting) the following data were taken as an average of three, randomly selected plants from each plot, percentage of nitrogen in different plant parts varieties,(root, stem and leaf). All plant parts was dried at 70°c and ground in a wiley mill to pass a 1 mm sieve in preparation for chemical analyses. Percentage of nitrogen of plants were determined by kjeldal and method. Quality factors (nicotine, total ash, burning time and sugar) were measured on the middle leaves cultivars per plot. The collected data were subjected to variance analysis using EXCEl software. Statistically significant differences among the means were determined by using LSD, with MSTATC software.

Results:

Leaf quality characteristics:

Nicotine, total ash and burning time were not significant differences between cultivars, but were significant differences between cultivars in percentage of sugar ($p<0/05$) (Table 1). The maximum and minimum sugar percentage were obseverd in Toleza 68 and DRV_1, respectively.

Table 1. Mean of cultivars leaf quality characteristics

Cultivars	Total ash ^{ns}	Burning time ^{ns}	Sugar *	Nicotine ^{ns}
DRV_1	13/87 a	11/5 a	3/37 ab	2/77 a
DRV_{10}	15/47 a	11/02 a	2/25 c	3/12 a
Madole	14/45 a	8/12 a	2/75 bc	2/71 a
Kentucky 171	15/52 a	8/52 a	3/6 ab	3/19 a
Toleza 68	14/52 a	9/07 a	3/9 a	3/16 a
Western	14/95 a	9/57 a	2/95 abc	2/82 a

ns, * : Non significant, significant at P= %5, respectively

Percentage of leaf nitrogen:

Cultivars were significant differences in leaf nitrogen percentage at 122 DAT ($p<0/05$). Leaf nitrogen increased with time from transplanting to flowering and decreased at late stages of growth (Table2).

Percentage of stem nitrogen:

Varieties weren't significant differences in stem nitrogen percentage. The maximum Absorption of stem nitrogen was at 42 DAT and then declined (Figure 1).

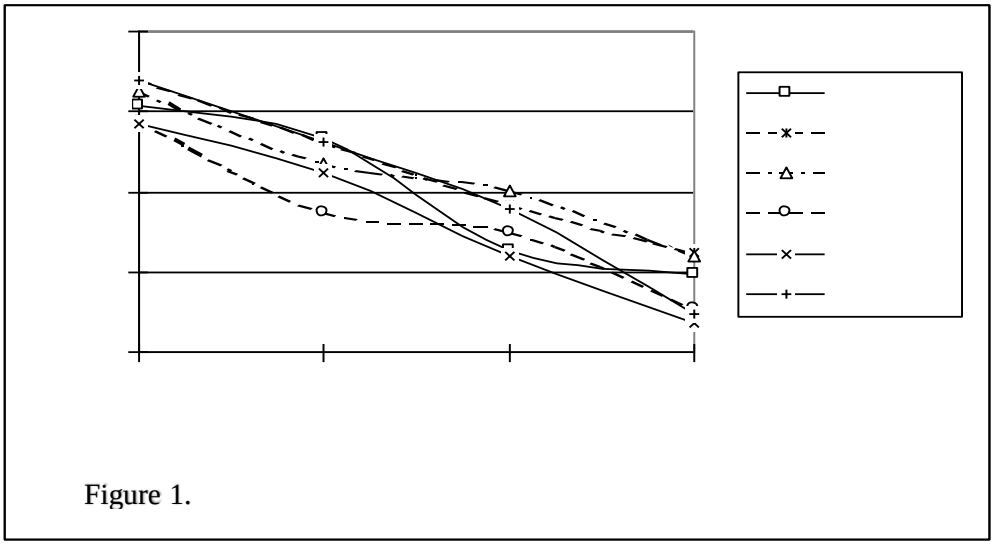

Figure 1.

Percentage of root nitrogen:

Changes in root nitrogen percentage of cultivars were significant differences ($p<0/01$) and other stages of growth weren't significant differences between cultivars. The maximum absorption of root nitrogen was at 42 DAT and declined from 58 to 122 DAT. Amount of root nitrogen in cultivars was more from leaf and stem nitrogen (Table 2).

Table 2. Mean of leaf and root nitrogen percentage in tobacco cultivars

Leaf (DAT)					Root (DAT)			
	42	58	94	122	42	58	94	122
Cultivars	*	ns	Ns	*	ns	*	ns	Ns
DRV_1	2/84 a	3/5 a	4/42 a	2/42 a	3/10 a	2/81 ab	1/69 a	1/39 a
DRV_{10}	3/14 a	3/52 a	4/02 a	2/49 bc	3/00 a	2/37 bc	1/40 a	1/25 a
Madole	3/24 a	3/63 a	4/13 a	3/14 a	3/21 a	3/47ab	1/73 a	1/22 a
Kentucky171	3/15 a	3/39 a	3/76 a	2/38 bc	2/63 a	1/83 c	1/43 a	1/23 a
Toleza 68	2/9 a	3/48 a	3/81 a	2/25 bc	3/11 a	2/98 a	1/48 a	1/10 a
Western	3/5 a	3/58 a	3/87 a	2/10 c	3/08 a	2/94 ab	1/76 a	1/10 a

ns, *, ** : No significant, significant at P= %5, significant at P=%1, respectively
DAT: Days after transplanting

Discussion:

Quality:

Cultivars sugar differences contribute to leaves curing conditions, hydrolysis of starch to free sugars, leaves ripeness and genetically factories (10, 16).

Nitrogen:

The uptake of cultivars nitrogen related to soil nitrogen storage, absorption, Transport and nitrogen partitioning percent in different plant parts varieties (2, 6, 12). Parts nitrogen contents were relatively high due parts activity, high relative growth rate, and amount of soil sufficient nitrogen during early growth. Tissue nitrogen amount declined with senescence, decrease of growth and soil nitrogen deplete at late stages of growth. Percentage of leaf nitrogen in madole and DAV_1 cultivars were nearly high due to period of long growth, low of leaf nicotine amount and rapid transport of stem and root nitrogen to leaves. Root of kentuckey 171 and DAV_{10} contained low concentration of nitrogen due to decrease of soil nitrogen uptake efficiency and root activity, and nitrogen was adsorbed for synthesis of nicotine in leaves (9, 12. 15).

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