Research Article

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Annals of Biological Sciences
ISSN 2348-1927

2022
Vol.10 No.6:033

The Effects of Transplanting Date on Growth and Prevalence of Bushy Top Disease of Flue-Cured Tobacco

Daniel Abebe*

Department of Research and Quality Assurance, National Tobacco Enterprise, Addis Ababa, Ethiopia

***Corresponding author:** Daniel Abebe, Department of Research and Quality Assurance, National Tobacco Enterprise, Addis Ababa, Ethiopia; Email: danjitu79@yahoo.com

Received: 05-March-2020, Manuscript No. M-3526; **Editor assigned:** 10-March-2020, PreQC No. P-3526; **Reviewed:** 24-March-2020, QC No. Q-3526; **Revised:** 31-May-2022, QI No. Q-3526; Manuscript No. R-3526; **Published:** 28-June-2022, DOI: 10.36648/2348-1927.10.6.033

Citation: Abebe D (2022) The Effects of Transplanting Date on Growth and Prevalence of Bushy Top Disease of Flue-Cured Tobacco. Ann Biol Sci Vol: 10 No: 6:033.

Abstract

An experiment was carried out during 2012 to 2013 at the field of Billatie leaf development farm, in wet and dry seasons, to investigate the effects of transplanting date on growth and prevalence of bushy top disease of flue-cured tobacco. The experiment was laid out in randomized block design with three replications. Tobacco plants (K-110) were transplanted at 10-days intervals for dry season 2012/13 November 9, 19, 29 December 9, 19, 29 and January 8 and 18, for wet season similarly eight transplanting dates in 2013 April 18, 28, May 8, 18, 28, June 8, 18 and 28. Analysis of the data showed that late transplanted dates significantly affected green leaf, growth parameters and bushy top incidence. Early planted in two seasons significantly increase leaf yield, growth parameters and decrease bushy top virus disease incidence. The study indicated that transplanted has pronounced positive effect on management of bushy top virus disease and growth of tobacco.

Keywords: Green leaf yield; Tobacco (flue-cured); Transplanting date; Green leaf yield

Introduction

Tobacco (*Nicotiana tabacum* L.) is most important crop grown as part of a cropping system and contributes to a diverse income source, and improves the welfare of growers in southern Ethiopia. In southern Ethiopia at small holder and the enterprise field tobacco leaf yield, quality and production remains low always under pressure of several constraints. A key constraint which is reflected in high tobacco production is the well understanding of early crop establishment factors [1]. Among these, the time of transplanting date is of great significance which determine ultimately effect on the yield and growth. The crop health yield and quality leaves of tobacco depend on improvement of cultural management like adjusting time of time of transplanting is essential agronomic practices. Tobacco rosette complex disease (bushy top) is caused by two component viruses. Tobacco Vein-Distorting Virus (TVDV) and Tobacco Mottle Virus (TMV) [2]. The latter is dependent virus and transmitted only when the former is present to help virus. Some virus can only be transmitted by aphids from the infected plant when the latter, in the meantime, is infected is called “help virus” and the transmission is called “dependent transmission”. It is considered that some unknown factors called “helper component” or “acquisition factors” occurring in the sap of infected plant with “help virus” enable the vectors to transmit the dependent virus [3]. The combinations of component occur in Zimbabwe, South Africa, Tanzania, Malawi and perhaps Pakistan and Thailand. The virus survives on other solanaceae. In order to reduce the incidence of TBTV it is recommended to plant tobacco early, use aphicide treatment on soil and/or plants, and remove virus reservoir plants.

In Ethiopia, it was reported that ecologically studies of recently emerged bushy top disease the help virus for causing disease is of tobacco associated with potato leaf roll virus. Since this virus is persistently transmitted by aphid and one of the vectors is tobacco aphid, *Myzusnicotiana* (Black man), it is very important all necessary measure be taken on seed bed and production field. Tobacco Bushy Top Virus (TBTV) was appeared in early 1995s as a threat to tobacco cultivation due to its prevalence resulting tremendous yield loss in Billatie. During the last 24 years the virus has emerged as devastating one causing economic loss of up to 100% in Billatie tobacco and out-grower’s farms. In many cases TBT epidemic lead to abandonment of the crop, particularly in season/period favoring tobacco aphid population build up [4]. Optimum time of transplanting important component of environmental conditions during different phonological stages, resulting in better performance of the crop in the control of bushy top disease has no attention in Billatie in shifting transplanting dates for tobacco. Hence, it is very important to find out the optimum time of planting for achieving best results in this area. Considering the importance of the above back ground, the present research trial was planned to find out a suitable date for the growth, yield and low prevalence of TBTV transplanting for K-110 variety in dry and wet season under ecological condition of Billatie [5].

Materials and Methods

An investigation was carried out at Billatie tobacco farm dry season 2012 to wet season 2013. One cultivar of Tobacco K-110 seedling was obtained from the farm. Seedlings were

transplanted in plot size 3.6 m × 5.4 m=19.44 m^2 (10 plants/row). Plant to plant and row to row distance were maintained as 60 cm and 120 cm respectively. The design of experiment was in RCBD design with three replications. Eight transplanted had dates for dry season: November 9, 19, 29 December 9, 19, 29 and January 8 and 18), for wet season: 2013 April 18, 28, May, 8, 18, 28, June 8, 18 and 28. Spacing between plants and rows were 60 × 120 cm respectively. All production practices were based on guide line provided by National Tobacco Enterprises (NTE) Virginia tobacco crop husbandry practice [6]. The land was ploughed with tractor, fertilizer was applied at a rate of 100 kg/ha urea and DAP used as source of the nutrient. After transplanting irrigation were applied 7-8 times. Three hand weeding were done at 30, 45 and 65 days after transplanting to keep the weeds under check. Transplanting a good and viable at age 70 old seedling was done in the main field at different dates as per the treatments. Topping was done before flowering at 24 leaf stage. The parameters studied were Plant height (cm), number of leaves plant-1, leaf area plant-1 and green fresh leaves yield in each plot (kg/plot) [7]. Data incidence of bushy top virus leaves was recorded based on symptom observed plant at mid growth stages using the modified double digit 00-99 scale. The two digital scores obtained were considered as the numerical disease description and used for statistical analysis. Monthly rainfall and daily maximum and minimum temperature recorded through the experimentation period. All statistical tests were done using the Analysis System (SAS, Institute, 2000) and mean values were compared by Duncan Multiple Range Test (DMRT).

Results and Discussion

Experimental site/location

The study was conducted at Billatie tobacco research site for two seasons, 2012 to 2013. The Billatie farm is located in Walaita zone of the South Nations and Nationalities Regional State (SNNPR), Ethiopia. Its geographical extent ranges from 6°48'30'' to 6°49'48'' North latitude and from 38°03'05'' to 38°06'02'' East longitude. Monthly rainfall, the mean minimum and maximum temperature recorded in Billatie tobacco farm during study season presented in **Table 1**. It is evident from the main data that the intensity of rainfall differs in two years. In 2012 cropping season total rainfall rained 719.4 mm. On the contrast, in 2013 crop season recorded 1188.1 mm [8]. In general 2012 year of scarcity of rain while 2013 normal year. Diurnal variation the maximum and minimum temperature in 2012 was 30.3°C and 16.8 °C respectively was not much difference temperature recorded 30.3°C and 16.7°C respectively in 2013 cropping season. The lower maximum temperature was recorded in 2012 cropping season July 26.6°C, whereas in 2013 cropping season July and august 26.3°C is recorded. In 2012 cropping season the less minimum temperature recorded in month of October 15.7°C and 2013 November 15°C. As such, the weather parameters other than rainfall did not appear to be a constraint for the crop growth. The soil of experiment field was loam in texture having Chemical characteristics of pH 7.09, Physical characteristic showed that 25% clay, 35% silt and 40% sand [9].

The total nitrogen and carbon of the soil was (0.084% and 1.05%) respectively. Electrical conductivity was 0.06.

Month	Rainfall in mm	Maximum temperature (°C)	Minimum temperature
January(2012)	0	33.7	17
February	4	35	16.3
March	9.5	35.7	18.3
April	137.4	31.1	17.1
May	38	31	17
June	67.1	27.9	17.5
July	196.8	26.6	17.2
August	78.3	27.7	16.7
September	82.9	27.9	16.4
October	41.1	29	15.7
November	65	32.3	16.1
December	5.8	32.8	16.8
Total/mean	719.4	30.9	16.8
January (2013)	47.7	33.4	17.8
February	5.8	35.1	18.5
March	65.8	33.3	18.2
April	243.5	30.3	17.4
May	94.7	28.5	16.8
June	92.2	28.8	16.9
July	146	26.3	16.3
August	162.1	26.3	16.5
September	29.9	29.3	16
October	159	29.7	16.2
November	141.4	31	15
December	-	31.9	14.6
Total/mean	1188.1	30.3	16.7

Table 1: Rainfall, maximum and minimum temperature recorded at Billatie tobacco farm during 2012-13.

Plant height at maturity (cm)

Data regarding plant height of tobacco indicated that transplanted dates of tobacco had significant ($P \leq 0.05$) on wet season trial. Taller plant (1.40 cm) were recorded tobacco transplanted an early on April 18 while the tobacco plants whose seedling was transplanted at 28 June was the shortest (0.35 cm). Dry season there was non- significant at $P<0.05$ among treatments except for late planted January 18 recorded the lowest plant height (0.09 cm) [10]. The shortest plants were produced crop planted at late transplanted during in the dry and wet season. This might due to environmental conditions and less crop duration growth. The results were in accordance with the findings.

Yield (kg/plant)

The treatments comprising of different transplanting dates have significance effect on the yield of tobacco in both seasons (**Tables 2 and 3**). The result indicated significant superiority for early short rain season on November 9, 19 and wet season April 18 harvested 1.3 kg/plant [11]. Late transplanted 18 January in dry seasonand July 28 in wet season (0.4 kg/plant) occupy the bottom position in the ranked order of treatments. Similar work by reported that a yield environment duration growth reduction approximately 80 kg ha-t for each week planting was delayed. It found that yield decrease approximately 8% per week from three weeks to five weeks past the normal transplanting date. In Canada, study of transplanting date showed delaying the yield date showed delaying planting by four weeks decrease yields from 8% to 36% [12]. The higher yields might be due to better establishment and to longer period available for vegetative growth of the plants in earlier plants which were more conducive.

Transplanted dates	Plant height	Green leaf yield (kg/ plant)	Leaf no/ plant	Size of leaves
Dry season (2012-2013)				
Nov 9 (2012)	1.42	1.3	26	1655
Nov 19	1.4	1.3	25	1662
47423	1.38	1.1	24	1953
40148	1.34	0.6	24	2418
43800	1.30	0.6	24	2850
47453	1.00	0.5	24	5511
Jan 8 (2013)	1.00	0.5	23	5760
43101	0.09	0.4e	22c	6288
Mean	1.3	0.78	24.5	3512
CV%	11.92	5.6	3.41	6.31
Wet season (2013)				
Apr 18 (2013)	1.40	1.3	19	1478
46844	1.19	1.1	18	138
39569	1.10	0.9	18	129
43221	1.09	0.9	18	1203
46874	1.05	0.9	17	1178
39600	1.02	0.6	17	1168
43252	0.74	0.5	17	762
46905	0.35	0.4	14	391
Mean	0.91	0.82	17.25	806
CV%	10.88	11.08	8.63	5.58

Table 2: Effect of date of transplanting on some agronomic traits at Billatie in dry and wet season 2012/13.

Transplanted dates	%incidence
43191	0.00
46844	0.00
39569	0.00
43221	0.00
46874	0.93
39600	3.70
43252	17.19
46905	17.92
Mean	4.96
CV%	16.56
Lsd 0.05	14.76

Table 3: Effect of date of transplanting bush top virus disease incidence in wet season 2013 cropping season.

Number of leaves per plants

The number of leaves per plant significant reduced from an early to late transplant in both main rain and dry season. The maximum number of leaves was produced in tobacco transplanted during early November on dry season and mid-April which superior over other transplanted dates. The lower leaf number was recorded in January 18 and June 28 dry and wet season respectively (**Table 2**). This might be due to well

distribution of rainfall in the crop planted during November and April which lead to increase in the growth characteristics of plant.

Leaves size (cm) per plant

The leaf size production of Virginia tobacco K-110 was influenced at different transplanted dates (**Table 2**). Among the different dates of planting the highest mean leaves size was obtained in the crop planted during as late transplanted on January 18 (6288 cm) for dry season, while early planting for increment of leaves size on an early transplanted on April 18 (1478 cm) for main rain season (**Table 2**). Earlier workers reported that leaf size increased for dry season for late planted and in wet season for transplanted early tobacco most likely these differences observed in two seasons due to response to air temperature. The potential mean area of leaf determined largely by the number of cell produced prior to the visual emergence of the leaf from the bud. Air temperatures can slow the rate of cell division as well as slow rate of metabolism in expanding leaves.

Bush top virus diseases prevalence

Transplanting date and tobacco bush top virus diseases significantly affect yield of tobacco. High incidence and lower yield were observed in later-planted, in which peak tobacco bush bush top disease incidence were high, especially for wet season planted tobacco. In wet season early transplanted tobacco April 18-May 18 were free from bush top virus disease. While, incidence of bush top increased sharply from May 28-June 28 (**Table 3**). Population due to the tobacco aphid, *Myzusnico ianae* the causal agent of bush top disease more tobacco aphid population was observed in late season while early planted tobacco may become infested with aphids earlier, but it matures earlier and the aphids have less impact on it. The results are in conformity with the earlier report revealed by that early planted tobacco can suffer less aphid damage than of transplanted near the middle and late of the planting period.

Conclusion

In the present research, tobacco variety K-110 for optimum yields in Billatie, tobacco should be planted earlier in dry season or at offset or onset of rain in wet season might be due to better establishments and longer period available for vegetative growth of plants, in earlier plants which were more conducive to produced high green leaf yield.

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