

PREFACE

West Bengal has a unique place on the tobacco map of India as it ranks fifth in hectareage amongst the provinces growing tobacco. Tobacco cultivation in West Bengal is mainly concentrated in the northern region comprising Cooch Behar, Jalpaiguri, West Dinajpur and Malda districts, covering an area of about 15000 hectares with annual production of about 16000 tonnes. West Bengal occupies a place of pride since three types of tobacco viz., Motihari (N. rustica), Jati and Cigar-wrapper, filler and binder (N. tabacum L.) are grown for Hookah (Hubble-bubble), chewing and cigar & cheroot purpose, respectively.

Hookah and chewing types are widely grown for local consumption, while cigar types have very specific requirement of soil and climate for production of fine textured, silky and velvety leaves with high elastic properties, good burn, pleasant taste and delectable aroma for which there are three pre-requisites such as slightly acidic soil (pH 6.5), high relative humidity and prolonged cold spell which is prevalent only in the sub-mountainous foot hill areas contiguous to Darjeeling of the state.

Presently, this State holds a unique place in the tobacco map of India, in general due to production of cigar tobacco and in particular for adoption of quality cigar wrapper tobacco. The crop, however, could not make any tangible breakthrough in the expansion of area and production, though there has been a pressing demand of wrapper tobacco in the cigar and cheroots industries. Modern agronomic techniques offer means of improvement in crop production, yet a practical guideline through research findings leading to higher yield of quality cigar tobacco are not adequately available and thus

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call for a thorough study on this crop for efficient cultivation to cater to the need of trade in India and also to bring a breakthrough in the overseas market.

For successful tobacco cultivation in this region, nursery management is one of the most important needs since the period of nursery sowing and growth of seedlings coincide with heavy rainfall period of August and September, which causes severe damage to the tender seedlings, such as, root lodging and wash off, incidence of pests and diseases. Over and above these, the seedlings are rendered succulent and weak, such seedlings cannot withstand scorching sun on transplanting in the main field and consequently cause severe mortality and gaps in the field. Nutrients management specially phosphorus and potassium can play an important role in production of sturdy and vigorous seedlings as nitrogen nutrition induces succulency. Since tobacco seed is very small in size (10-12 thousand seeds per gram of weight), nutrient reserve in the seed is very low. Thus, an optimum dosage of phosphorus and potassium will result in production of healthy seedlings while higher dosage of these nutrients will lead to adverse effect on seed germination and growth of seedlings.

After transplanting of cigar wrapper tobacco, level of nutrients application to the soil play very important role on growth and development of the plants. Nitrogen is regarded as the basic constituent of plant life as it is an essential constituent of protein and chlorophyll. Its influence on leaf size, physical and chemical quality parameters are noteworthy features which determine suitability of the produce for use as wrapper tobacco.

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Phosphorus is an essential constituent of nucleic acid, phytin and phospho-lipids. An adequate supply of phosphorus induces early completion of vegetative phase with early maturity since it plays an important role in most of the enzymatic process of metabolism and catabolism of carbohydrates. Heavy levels of phosphorus, can counteract the ill effects of nitrogen nutrition. It promotes root growth and helps plants in quick establishment on transplanting. /o

Potassium imparts vigour and disease resistance to the plants. It regulates the ratio of proteins to carbohydrates and prevents undue accumulation of nitrogen in the leaves, activates cellular activities, gives healthy tone to the plants and yields higher with superior quality. Both nitrogen and phosphorus have intimate relationship with the yield of tobacco. Nitrogen in presence of phosphorus enhance yield while without phosphorus the quality of the produce is adversely affected.

North Bengal soil being acidic in reaction and deficient in calcium and magnesium but very rich in the oxides of aluminium and ferrous application of lime (calcium carbonate) may serve as soil amendment and also can meet the calcium needs of the plants, which can enhance yield and quality of wrapper tobacco. Boron deficiency is also widespread in the northern region of West Bengal, which needs to be supplemented judiciously to mitigate the deficiency symptoms of boron on the plants.

Cigar wrapper tobacco is relatively a new introduction in north Bengal. When a crop is introduced in a new environment, it calls for studies on various aspects, such as, time of planting, plant spacing, nutrients and water

requirements etc. for better understanding of the crop needs so as to coincide them according to the requirement of the crops at different growth phases for luxuriant development of the crop. Variations in the prevalent climatic conditions actually determine the time of planting and if optimum time of planting of a crop is decided according to needs of climatic factors at different phases of growth and development, the yield and quality of the produce is bound to improve if other growth factors are not limiting.

Plant spacing or plant density per unit area is another most important adjunct which directly controls the yield potential and fertilizer response of a crop. An optimum plant population regulates competition among the plants for different growth factors. In tobacco, it has been observed that wider plant spacings generally result in production of more number of primable leaves per plant, while closer plant spacings result in production of smaller and thinner leaves. When plants vary in growth habits under different times of planting or plant spacing, they respond differently to growth factors. Sometime late planted crop is generally poor in growth and yield which can be augmented by increased plant population and nitrogen nutrition.

Keeping the above points in view, a series of experiments have been conducted at Central Tobacco Research Institute Research Station, Dinahata, Cooch Behar, West Bengal on different aspects of phosphorus and potassium on seedlings production, individual and combined effect of N, P and K, boron and liming, time of planting and plant spacings, and their influences have been ascertained on growth, yield and physical-chemical quality characteristics of cigar wrapper tobacco with the aim of pinpointing their optimum requirements for production of standard quality of tobacco in north Bengal.

Effect of varying treatments in different experiments is assessed by measurement of leaf size, number of curable leaves, total cured leaf yield, first grade yield, magnitude of midrib and veins in the lamina, leaf thickness and elastic properties, chemical constituents in the leaves, smoking quality of the cigars, economics of treatments, etc., and the results in brief are summarised in the following paragraphs.

Observations on the experiment conducted from 1982-83 and 1983-84 revealed that the increasing doses of phosphorus viz., 0, 30, 60 and 90 kg P_2O_5 /ha tended to increase the speed and extent of germination per unit area of nursery. Application of 90 kg P_2O_5 though not differing with 60 kg P_2O_5 /ha in respect of speed and extent of germinations which was significantly superior to 0 and 30 kg P_2O_5 /ha. Phosphorus levels have induced the speed of germination as the seedlings reached to proper stage within 10 days of sowing as compared to 12 days required with the treatments lacking in phosphorus application. Potassium levels, on the other hand, could not manifest any discernible effect on germination. Interaction effect of phosphorus and potassium levels was significant on germination counts.

Leaf area and dry matter of seedlings on 25, 32, 40, 47 days after sowing were recorded. The influence of phosphorus levels was reflected on the growth of seedlings during the 47 days after sowing, when the levels of 60 and 90 kg P_2O_5 /ha recorded the highest leaf area. Application of potassium could not manifest any discernible influence on the leaf area of seedlings. Dry matter of seedlings increased with the levels of phosphorus particularly during 40 and 47 days after sowing as every enhanced dose of phosphorus

increased dry matter of seedlings. Similarly, application of potassium levels (20, 40, 60) have also influenced dry matter production particularly during the 47 days after sowing.

The levels of 30, 60 and 90 kg P_2O_5 /ha gave 7.5, 13.2 and 24.3 per cent more number of transplants, respectively, over the control. Response of potash on the number of transplants was rather obscure.

Three levels of N, P and K (3^3) are studied in partially confounded design. Observations revealed that the number of curable leaves, total cured leaf yield, first grade out turn are remarkably influenced by individual and combined effect of N, P and K. Application of 130 kg N/ha accounted for 14% more yield as compared to 65 kg N/ha and 80% more than the control (0). Every increasing dose of phosphorus brought about linear increase in yield, showing 10% and 14% more yield with the level of 65 and 130 kg P_2O_5 /ha, respectively, as compared to the control (0). Increase in yield is attributed to the leaf number, size and thickness. Similarly, potassium levels also manifested linear increase in yield of wrapper tobacco.

Magnitude of midrib and veins also varied significantly due to different levels of N, P and K. Leaf thickness increased with nitrogen levels while P and K levels exhibited adverse effect on leaf thickness. Leaf extensibility and elongation also increased with increasing doses of N, P and K. Higher dose of N, P and K produced leaves having higher elongation as compared to their '0' level. Chemical composition of the leaves produced with different levels of N, P and K revealed that the total content of nitrogen was more with

the higher doses of N, P and K. Also, N and P have enhanced nicotine content of leaves while K could not reflect any definite trend. Cigar smoking quality is also influenced by the levels of N, P and K. Interaction effect of NP and NK was also significant on yield and quality attributes of wrapper tobacco. The net monetary returns from various combinations of NP, NK, PK and NPK manifested that the highest net profit of Rs. 15,152 per hectare was recorded with the combination of 130 kg N, 130 kg P_2O_5 and 150 kg K_2O /ha.

Lime and boron applications have expressed their influences on leaf size, leaf area and cured leaf yield. Application of boron upto 0.400 kg B/ha tended to enhance the leaf yield. Influence of liming is also significant on yield as well as leaf quality as compared to no liming. Moreover, liming has slightly impaired the smoking quality of cigars. Profit and loss account of lime and boron nutrition has manifested that liming alone required additional cost of Rs. 3,168 per hectare which was not economical, while boron nutrition @ 0.400 kg B/ha was an economical proposition.

Variations in planting time and planting densities have also exhibited marked influence in growth, cured leaf yield, first grade leaf yield, chemical composition of leaves, smoking quality and economics of different treatments. The results manifested that early planting of wrapper tobacco between October 10 and 25 is superior to late plantings. Total and protein nitrogen contents, nicotine etc were higher due to early planting. Similarly closer plant spacing also brought about increased leaf yield. Yield attributes as also the total cured leaf yield increased with increasing levels of nitrogen in different combinations of dates of planting and planting densities. Early

planting with 75 cm x 45 cm planting spacing and application of 180 kg N per hectare was most economical.

The studies thus have convincingly held out a promise of large scale commercial production of cigar wrapper tobacco in the district of Cooch Behar and the adjoining districts through raising healthy and vigorous seedling with modern nursery management and economically viable agrotechniques. The investigations referred to above have been dealt with in details under three independent chapters comprising the Thesis.