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MORPHOLOGICAL CHARACTERS AND DRY MATTER PARTITIONING IN RULING FCV TOBACCO CULTIVARS IN KARNATAKA

M.MAHADEVASWAMY, C. NANDA, S.RAMAKRISHNAN, S.RAMESH, C. MAHADEVA, S.S.SREENIVAS AND T.VENKATESH

ICAR-Central tobacco Research institute, Research station, Hunsur, Karnataka - 571105

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In FCV tobacco, leaf is the economical portion and the present agronomic practices are more oriented towards greater leaf area development and quality leaf production. An attempt was therefore made to understand the growth pattern, dry matter production and its distribution in different parts of the plant system and their implications for agronomic manipulations in certain promising and ruling FCV tobacco cultivars in KLS. Five plants were selected at random from each of the ruling varieties of KLS (Kanchan, CH-3, FCH 222 and KLSH-10) grown under recommend package of practices. The selected plants were separated into leaf, stem, root and inflorescence and fresh weight, leaf area, Leaf Area Index, dry weight of each plant parts and proportionate dry matter contribution, Leaf: stalk ratio and hundred leaf weight were determined. The total dry matter production was maximum in CH-3 (206.6 g/pl) followed by KLSH-10 (196.4 g/pl), while the other cultivars like FCH 222 and Kanchan produced comparatively lower total dry matter production (ranging from 177.0 – 184.5g/pl). The maximum contribution of leaf to TDM observed in CH-3 due to higher no. of leaves produced/pl., higher leaf area/plant and higher hundred leaf weight (test weight 540 g). The proportionate contribution of leaf dry matter to TDM was 48.7% in CH-3 compared to FCH 222 (46.1%), Kanchan (45.6%) and KLSH-10 (43.1%) indicating the differential efficacy of these cultivars in accumulating proportionately more dry matter in the leaves. The Leaf: Stalk ratio was also highest in CH-3 (1.81) compared to other cultivars (1.50-1.52) indicating the higher production potential of this cultivar under these conditions. Based on these observations, further research efforts can be attempted to maximize the proportionate leaf dry matter contribution in the plant through possible agronomic/cultural practices in a given soil and growing conditions for different cultivars.

Key words: FCV tobacco cultivars, Leaf Area Index, Total dry matter production, Dry matter partioning

INTRODUCTION

Flue cured Virginia (FCV) tobacco (*Nicotiana tabacum*) is an important cash crop grown under rainfed situations in Southern Transition Zone of Karnataka. The crop produced in this zone is popularly known as KLS (Karnataka Light Soils) tobacco which is having high export demand in the international market. Unlike other grain crops, leaf is the economical portion in tobacco and the present agronomic practices are much oriented towards greater leaf area development and quality leaf production (Giridhar, 2000) for sustaining export potential and stabilizing farm income. The leaf numbers, shape, size and thickness of leaf greatly varies with the cultivars grown and their growing conditions. In tobacco, leaf is the major dry matter synthesizer and the growth energy provider (Rawson and Hackett, 1974). Hence, dry matter production and accumulation in leaf has a greater bearing on the economic value of this crop. Further, the proportionate contribution of the leaf to the total dry matter (TDM) production depends on the extent of dry matter production in other parts of the plants like root, stem and inflorescence etc., as well as source-sink relationship for a particular variety. An attempt was therefore made to understand the growth pattern, dry matter production and its distribution in different parts of the plant system and their implications for agronomic manipulations in certain promising and ruling FCV tobacco cultivars in KLS.

MATERILAS AND METHODS

The study was conducted at ICAR-CTRI Research farm, Hunsur on sandy loam soils during the *kharif* crop season of 2017. Two varieties (Kanchan and FCH 222) and two hybrids (CH-3 and KLSH-10) are included to know their growth

habits, field performance etc in the given environment so that further investigations would be possible for improving the desired growth parameters by agronomic/ breeding measures for enhancing productivity and quality in rainfed environments of KLS. KLSH-10 being a promising and potential hybrid in KLS, it was included in the study. Five plants were selected at random from each of the cultivars grown under recommend package of practices. The crop was planted during the last week of May 2017 and one life saving irrigation was given during the active growth period of the crop due to drought conditions prevailed during the growth period. The varietal characters and the cultural practices followed are given in Table 1. The selected plants were uprooted carefully at the time of flowering (topping stage) and were separated into leaf, stem, root and inflorescence and fresh weight of each plant parts were recorded. The leaf area of each plant was calculated by measuring the length and breadth of the leaf multiplied by the known factor developed (*Mahadevaswamy et.al, 2003*) for FCV tobacco cultivars in KLS. The leaf area index was then calculated by using the formula: Leaf Area per plant /Land Area per plant. The samples were then dried at 65-70^0 C in hot air oven and their dry weights were recorded for calculating dry matter production. The total dry matter produced and the proportionate dry matter of individual plant parts was worked out.

RESULTS AND DISCUSSION

The various morphological characters like number of leaves produced per plant, plant height, leaf area, Leaf Area Index (LAI), total dry matter and the above ground dry matter production are given in Table 2.Number of leaves produced per plant ranged from 17.2 to 18.6 in various cultivars with CH-3 recording the maximum value. With respect to plant height, KLSH-10 and CH-3 recorded higher plant height (84.6-89.4 cm) compared to other cultivars which are characterized by dwarf nature (78.0-81.6 cm). The cultivars CH-3 and FCH 222 with broad leaf type recorded the maximum leaf area ranging from 16,319 to 16,946 cm^2 compared to leaf area of 15,382 to 15,651 cm^2 with Kanchan and KLSH-10 respectively (having relatively less width and narrower types). The leaf moisture content ranged from 86.2 to 88.3% with not much variation among the different cultivars. The Leaf Area Index (LAI) which is an indicator of better leaf spread and ground coverage was higher in cultivars FCH 222 and CH-3. Such types may be of much helpful in better interception and utilization of sun light at optimum soil fertility and moisture situations. The total dry matter production including all the parts (leaf, stem, root and inflorescence) was maximum in CH-3 (206.6 g/pl) followed by KLSH-10 (196.4 g/pl), while the other cultivars like FCH 222 and Kanchan produced comparatively lower total dry matter production (ranging from 177.0 – 184.5g/ pl). The above ground dry matter production showed similar trends. The higher TDM in these cultivars is due to combination of higher leaf area as well as plant height (stalk weight) which contributed to higher dry matter production.
However, in FCV tobacco cultivation, leaf being the economical and commercial part of the plant, leaf dry matter and the proportionate contribution of the leaf to the total dry matter production is of very much importance from the productivity point of view. The dry matter production of the individual parts of the plant, their proportionate contribution to the TDM, Leaf: Stalk ratio and the hundred leaf weight (dry matter weight) are given in Table 3.The production of leaf dry matter was highest in CH-3 (100.6 g/pl) compared to KLSH-10(84.8 g) and Kanchan (84.4 g), and lowest in FCH 222 (81.6g). The maximum contribution of leaf to total TDM in CH-3 is due to higher no. of leaves produced/pl., higher leaf area /plant and higher hundred leaf weight (test weight 540 g). The proportionate contribution of leaf dry matter to the total dry matter production was 48.7% in CH-3 compared to FCH 222 (46.1%), Kanchan (45.6%) and KLSH-10 (43.1%) indicating the differential efficacy of these cultivars in accumulating proportionately more dry matter in the leaves. In USA, considerable variations were noted in the proportionate contribution of various parts of the plant to the total dry matter production (Loche and Deletang, 1970).

The percent root dry matter contribution to TDM ranged from 17.7-20.8% with KLSH-10 showing comparatively higher root dry matter contribution (20.8%) which can be of much useful

Table1: Morphological characters and agronomic practices adopted in ruling FCV tobacco cultivars.

Varieties/cultivars	Morphological characters	Recommended spacing and fertilizer dose
Kanchan	Dwarf, Semi-open type with short internode length, leaves are long and narrow with heavy body	100 x 55 cm60:40:120 Kg N:$P_2O_{5:}$ K_2O/ha
FCH 222	Medium tall, open plant type with medium internode length, leaves are broad and boat shaped medium body.	100 x 55 cm60:40:120 Kg N:$P_2O_{5:}$ K_2O/ha
CH-3	Medium to semi dwarf, Semi open type, fairly broad leaf with thick body.	100 x 55 cm70:40:120 Kg N:$P_2O_{5:}$ K_2O/ha
KLSH-10	Medium tall, open plant type with medium internode length, leaves broad and long with medium body.	100 x 55 cm60:40:120 Kg N:$P_2O_{5:}$ K_2O/ha

Table 2: Growth characters and mean dry matter production (g/plant) in FCV tobacco cultivars

Cultivars	No. of leaves	Plant height (cm)	Fresh weight (g/pl)	Dry weight (g/pl)	Above ground dry weight (g/pl)	Leaf % % moisture	Leaf Area/ (cm^2)	LAI
Kanchan	17.4	78.0	1546.8	160.4	123.6	89.6	15651	2.84
CH-3	18.6	84.6	1633.2	182.7	142.5	88.8	16319	2.96
FCH 222	17.4	81.6	1492.4	154.8	122.0	89.6	16946	3.08
KLSH-10	17.2	89.4	1664.6	168.5	127.5	89.8	15382	2.79

*Figures in the parenthesis indicate the per cent contribution

Table 3: Dry matter partitioning, Leaf: Stalk ratio and hundred leaf weight in FCV tobacco cultivars

Cultivars	Dry matter partitioning in different plant parts (g)				Leaf: Stalk Ratio	Hundred leaf Weight (g)
	Root	Stem	Leaf	Inflorescence		
Kanchan	32.8 (20.9)*	31.0 (20.0)	84.4 (52.6)	12.2 (7.8)	2.72	485.5
CH-3	40.2 (22.0)	31.6 (17.2)	100.6 (55.0)	10.3 (5.7)	3.18	540.0
FCH 222	32.8 (21.2)	31.4 (20.3)	81.6 (52.7)	9.0 (5.8)	2.59	469.0
KLSH-10	41.0 (24.3)	33.5 (19.9)	84.8 (50.3)	9.2 (5.5)	2.53	493.0

in better exploitation of soil moisture especially under moisture stress/drought situations. The percent stem contribution to TDM production was comparatively more in FCH 222 and Kanchan which implies for greater Leaf area development in these cultivars through agronomic manipulations like crop geometry and planting density for increasing the proportionate leaf dry matter contribution. The Leaf: Stalk ratio was also highest in CH-3 (1.81) compared to other cultivars (1.50-1.52) indicating the higher production potential of this cultivar under these conditions. In variety Kanchan, the infloresnce contributed 7.8% to the total DM while in rest of the variety it ranged around 5.5-6.0%, which implies greater effect of topping on the leaf productivity in this cultivar. Similar trends were noticed in the earlier studies with Kanchan grown under similar climatic conditions (Mahdevaswamy *et al.,* 2009*).*

The study has given indications that that the cultivars possessing early and higher number of leaf production/plant, higher leaf area development and higher leaf test weight will be the key factors for maximizing FCV tobacco leaf productivity per unit area. Based on these observations, further Research efforts can be attempted to maximize the proportionate leaf dry matter contribution in the plant through possible agronomic/cultural practices in a given soil and growing conditions for different cultivars.

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