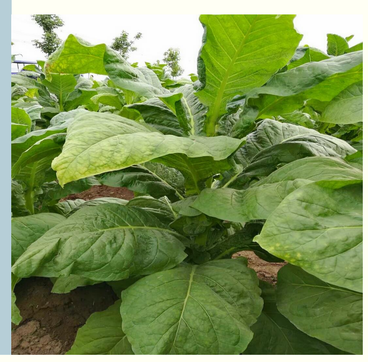
Effects of delayed harvest on tobacco quality of upper six leaves and climatic requirement in central Henan of China

GAO Zhenzhen[1], YANG Mingkun[1], LIU Kouzhu[1], LI Jianhua[2],
LI Hongliang[2], SHI Hongzhi[1]*
(1.College of Tobacco Science of Henan Agricultural University, Tobacco Cultivation Key Laboratory of China Tobacco, Zhengzhou 450002, China; 2. Xuchang Tobacco Company of Henan Province, Xuchang 461000, Henan, China)



Introduction

Upper tobacco leaves have higher quality potential and play an important role in the production of low tar cigarette. With rich matter, high aroma and strength, upper leaves have greater pottential to produce high quality cured tobacco leaves. According to the current harvesting standard, the maturity of upper leaves is generally low in reality and the degradation is not complete. Hence, increasing the maturity of upper leaves by delaying harvest is an important approach to improve the availability of upper leaves. A series of experiments were carried out in central Henan province from 2017 to 2018 to investigate the effects of delaying harvest date on leaf quality, and to establish the climatic indexes required for the production of high quality upper tobacco leaves.

Methods

- Experiment I: Harvesting date experiment included five treatments (normal date: control, and delayed 4, 8, 12, 16 days). The mature tobacco leaves were cured normaly, and the yield, output value and sensory quality of the tobacco samples were evaluated.
- Experiment II: A two-factor (transplanting date and harvesting date) field experiment was conducted to investigate the relationship between climatic parameters during the growth of upper six leaves and the quality of cured tobacco leaves. The climatic data were collected using HOBO/NRG small meteorological monitoring station.

Results

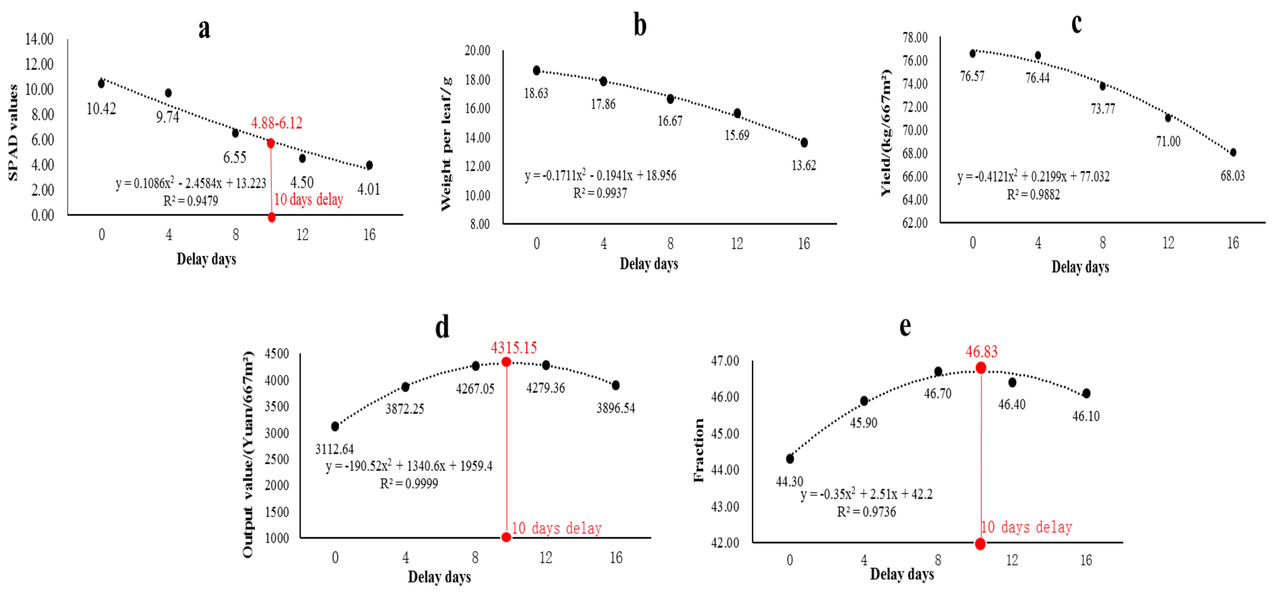


Figure 1. The changing trend of SPAD value (a), economic traits (b:Weight per leaf , c: Yield, d:Output value) and sensory quality (e) of the upper six tobacco leaves at different harvesting dates

With the delay of harvesting date, the SPAD value, weight per leaf and yield of the upper six leaves showed a continuous downward trend, while the output value and sensory evaluation quality increased to a highest point before declining.

SPAD value between 4.9-6.2 was proved to a proper index to evaluate the optimum maturity.

When delayed for 10 days, the output value and sensory evaluation quality reached the maximum, which were 19.03% and 7.36% higher than that of normal harvest (control), respectively. Meanwhile, the tobacco leaves are characteristic of richer aroma, better taste and more satisfaction.

Table 1 The relationship between climate factors and sensory quality of the upper six leaves at different growth periods

Sensory Quality index	Climate index	Mature period				Period of duration			
		Equation of trend line	Determination coefficient	The value of X at the maximum of y	The range of values of x when y is maximum	Equation of trend line	Determination coefficient	The value of X at the maximum of y	The range of values of x when y is maximum
Display degree	Average temperature	$y = -0.5934x^2 + 31.095x - 399.34$	0.94**	26.0	25.26~27.14	$y = -0.688x^2 + 36.378x - 472.89$	0.76**	26.5	25.5~27
	Days of maximum temperature >30℃	$y = -0.0096x^2 + 0.533x + 0.6326$	0.83**	29.0	25~33	$y = -0.0067x^2 + 0.815x - 16.79$	0.83**	61.0	52~70
Fragrant temperament	Accumulated temperature >0℃	$y = 0.0522x^2 + 1.3235x - 1.2897$	0.91**	1267.7	1122.97.0~1268.26	$y = -0.0408x^2 + 1.7751x - 12.217$	0.96**	2175.4	2018.0~2332.8
	Accumulated temperature >10℃	$y = -0.1396x^2 + 2.191x - 1.4891$	0.90**	784.9	692.97~871.39	$y = -0.1255x^2 + 3.3682x - 15.485$	0.97**	1341. 9	1257.9~1425.9
	Accumulated temperature >20℃	$y = -1.2227x^2 + 7.0236x - 2.9446$	0.96**	287.2	262.97~313.30	$y = -1.0704x^2 + 11.158x - 21.94$	0.92**	521.2	497.9~544.5
	Days of temperature >20℃	$y = -0.0026x^2 + 0.2632x + 0.4673$	0.89**	51.0	51~55	$y = -0.0023x^2 + 0.392x - 9.4559$	0.88**	85.0	76~94
	Lighting hours	$y = -8E\text{-}05x^2 + 0.0489x - 0.2405$	0.91**	305.0	264.0~347.2	$y = -6E\text{-}05x^2 + 0.0606x - 8.1646$	0.96**	505.0	464.5~545.5
Fragrant gas volume	Accumulated temperature >0℃	$y = -0.0679x^2 + 1.7223x - 3.3121$	0.90**	1268.3	1123.0~1268.3	$y = -0.0506x^2 + 2.2253x - 16.828$	0.87**	2198.9	2018.0~2332.8
	Accumulated temperature >10℃	$y = -0.186x^2 + 2.9097x - 3.7554$	0.91**	782.2	693.0~871.4	$y = -0.1542x^2 + 4.1872x - 20.8$	0.92**	1357.7	1258.0~1425.9
	Accumulated temperature >20℃	$y = -1.5315x^2 + 8.942x - 5.3945$	0.93**	291.9	263.0~313.3	$y = -1.4981x^2 + 15.639x - 33.146$	0.95**	522.0	497.9~544.5
	Days of temperature >20℃ days	$y = -0.0025x^2 + 0.2669x + 0.5038$	0.91**	53.0	51~55	$y = -0.0027x^2 + 0.4692x - 12.482$	0.88**	87.0	76~94
	Lighting hours	$y = -0.0001x^2 + 0.0612x - 1.6721$	0.92**	306.0	264.0~347.2	$y = -8E\text{-}05x^2 + 0.0812x - 12.949$	0.96**	507.5	464.5~545.5

The full flavor style of upper six tobacco leaves was more significant when the average daily temperature was 25.26~27.14℃ during the mature stage.

The quality of upper six tobacco leaves was best when the accumulated temperature (>20℃) was 263.0~313.3℃ for the mature stage and 497.9~544.5℃ for the whole period of growth of upper 6 leaves, respectively, and the number of days with average daily temperature >20℃ should be 51~55 d and 76~94 d, respectively.

Conclusion

Delaying harvest time appropriately improved the quality of the upper six tobacco leaves and SPAD value of 5-6 could be an ideal indicator for best harvesting. More accumulated temperature was required for high quality upper tobacco production , and higher average temperature was the key to the formation of typical full flavor tobacco style.

Presented at 2019 CORESTA Agro-phyto Conference ,Oct 12-17,2019 / Victoria Falls, Zimbabwe