Sci.Int.(Lahore),28(4),4109-4112,2016 ISSN 1013-5316;CODEN: SINTE 8

EFFECT OF GREEN MANURE, *SESBANIA BISPINOSA* WIGHT ON LINT QUALITY CHARACTERISTICS IN COTTON.

Jam Ghulam Mustafa Sahito[1*], Tajwar Sultana Syed[1], Ghulam Hussain Abro[1], Inayatullah Rajpar[2]

[1]Department of Entomology, Sindh Agriculture University, Tandojam.

[2]Department of Soil Sciences, Sindh Agriculture University, Tandojam.

Corresponding author* Jam Ghulam Mustafa Sahito

Email: gmustafajam@gmail.com

ABSTRACT. *Cotton is the key component of Pakistan's economy providing major share for foreign exchange earnings, employment and GDP. However, there are many constraints to cotton production and lint quality owing to heavy use of synthetic chemicals. Therefore, this study was conducted to evaluate the effect of use of green manure Sesbania bispinosa on the lint quality parameters of cotton. Results of the two years study confirmed that cotton grown in S. bispinosa treatment showed better or comparable lint quality paramteres of SCI (Spinning Consistency Index), Micronaire (MIC), Fiber Maturity Index, Upper Half Mean Length (UHML), Uniformity Index (UI), Short Fiber Index (SFI), Elongation, Whiteness of color RD and yellowness of color. Therefore, the potential of S. bispinosa to give improved yield and quality of cotton should be further investigated for large scale usage with additional advantage of green farming less dependent on synthetic chemicals.*

Key words: *Sesbania bispinosa,* Organic Cotton, Lint Quality, Cotton

INTRODUCTION

Cotton is a major industrial plant for many countries, including Pakistan [1, 2]. Unfortunately, cotton cultivation has been often characterized by high water requirements and use of substantial amounts of fertilizers and pesticides [3]. Approximately, 25% of the world's insecticides and more than 10% of all agrochemicals are used on cotton crop [4, 5]. This reliance on fertilizers and pesticides has reduced ground water quality worldwide [2]. Therefore, to reduce the adverse environmental impacts, management methods with less dependence on agro-chemicals are required. Organic cultivation of cotton is among the several reliable options for overcoming such problems [5]. The demand for organic fiber in the European and international market is increasing, despite its higher price [4]. However, there is still limited information concerning several aspects of organic cotton cultivation [6, 2]. Organic cotton produced after incorporation of green manure appears to be superior to conventional cotton production, even when a flat price is taken into account [7]. The quality of ginned cotton is highly variable and determines the suitability of the product for various industrial uses. In most cases, the price received by cotton producers depends on fiber quality, as well as yield. Therefore, interest on cotton fiber quality has increased [8]. Fiber length has always been important to cotton manufacturers and since the introduction of the rotor spinning technology in 1970, importance of micronaire and fiber strength have also increased [9]. Other fiber quality characteristics include uniformity, maturity, elongation, short fiber index and coloring [10]. Cotton fiber quality is mainly determined genetically, but management practices also have an important impact on fiber quality [11, 12, 13, and 14]. Indeed, many cultural practices, especially in the period of flowering affect fiber quality [15, 16]. Previous studies have shown that fiber quality is influenced by both genetics and soil nutrient supply. Fiber length is strongly influenced by genotype [17], while fiber strength and micronaire are influenced by climate and management [18]. Organic management systems that include cover crops influence many soil nutrients including N and water. The purpose of this study was to compare organic and conventional cropping systems with a special focus on the quality characteristics of the cotton fiber.

MATERIAL AND METHODS

Location and Experimental Design

The study was conducted at Latif Experimental Farm, Sindh Agriculture University Tandojam, Sindh during cropping seasons 2013-14 and 2014-2015. The experiment comprised of two treatments: green manure and control. A Randomized Complete Block Design (RCBD) with four replications was used for the experiment. The treatment plot size was 40x50 sq. meters and the replication plot size was 10x50 sq. meter. The type of soil used in the study was clay loam with good texture.

Cotton variety (Sindh-1) was planted on May 15, 2014 and May 8, 2015 by dibbling method on furrows in both green manure, *Sesbania bispinosa* and control treatments plots. During both cropping seasons, *S. bispinosa* was cultivated on 11.12.2013 and 15.12.2014, respectively. Three months after cultivation, the standing crop was harvested and pulverized in soil before the cultivation of cotton. Weeding and inter-culturing in the crop was carried out manually one month after the germination of crop. Subsequent agronomical practices were carried out as per standards and crop's requirements.

Lint quality characters:

The lint samples for different treatments were collected separately and samples were properly labeled and stored before carrying out lint quality tests. Four samples per treatment, one per replicate were taken and analyzed. Before analysis, samples were cleaned and trash was separated out. After collecting samples**,** ginning was carried out for separation of the lint and seeds from seed cotton on ginning machine, at Latif Farm, Sindh Agriculture University, TandoJam. From both treatments (organic and control).

All the observations of lint quality parameters were recorded using USTER HVI 1000 machine at Pakistan Cotton Standard Institute, Cotton Fiber Testing Laboratory, Sanghar Ministry of Textile Industry, Government of Pakistan. The

following lint quality parameters were obtained through this machine:

SCI (Spinning Consistency Index): It is a measure of cotton lint to measure spinability and overall quality of the cotton fiber.

Micronaire: Micronaire is calculated by measuring the relative resistance of specific surfaces of the cotton fibers to airflow.

Fiber Maturity: Fiber maturity ratio is based on the calculation of various algorithms of HVI™ measurements.

Upper Half Mean Length, Uniformity Index, Short Fiber Index: All these parameters are measured optically in a tapered fiber beard that was mechanically arranged, carded and brushed.

Strength: Strength of the elongated fiber is calculated by fastening a fiber bundle between two pairs of bundles at given distance. The first fasten bundle of fiber was pulled by the second bundle at constant speed until first bundle breaks and the distance it travels before breaking is known as elongation.

Moisture: Moisture content of the cotton sample was calculated using conductive moisture probe. Color: Rd (Whiteness), +b (Yellowness), Color Grade Measured optically by different color filters, converted to USDA Upland or Pima Color Grades or regional customized color chart.

Maturity index: The maturity index was calculated from all cotton seeds.

Statistical Analysis of data

The data collected were subjected to statistical analysis as student t-test was used to compare means of various lint quality paramteres in the individual years, whereas, analysis of variance was carried out to analyse the data for both years. The means were compared for significance of the treatment means using LSD test (Gomez and Gomez, 1984). The statistical package Statistix-8.1 was used for analysis of data.

RESULTS

Table 1 shows the results on the effect of green manure on the lint quality parameters of cotton during 2014. According to results, significant effect ($p < 0.05$) of application of green manure (dhancha) was recorded short fibre index (SFI) as higher SFI was recorded in dhancha treated cotton (11.22±0.51) in comparison to control (9.26±0.34). However, values of SCI (103.00±0.2.51) and UI (79.17±0.38) were significantly higher ($p < 0.05$) in control as compared to dhancha treated cotton with values of 83.67±0.76 and 81.37±0.52, respectively. No significant difference ($p > 0.05$) was recorded in remaining lint quality parameters of cotton between dhancha and control cotton.

In contrast to 2014, no significant difference ($p > 0.05$) was recorded between dhancha and control treatments in respect to various lint quality parameters of cotton (Table 2).

In contrast to 2014, no significant difference ($p > 0.05$) was recorded between dhancha and control treatments in respect to various lint quality parameters of cotton (Table 2).

Table 1. Effect of application of green manure, *S. bispinosa* on lint quality parameters of cotton during 2014

Lint quality parameter	*S. bispinosa*	Control
Spinning Consistency Index (SCI)	83.67±0.76b	103.0±2.51a
Micronaire (MIC)	4.46±0.11a	4.53±0.005a
Fiber Maturity Index	0.87±0.003a	0.87±0.00a
Upper Half Mean Length (UHML)	0.97±0.02a	1.01±0.002a
Uniformity Index (UI)	79.17±0.38b	81.37±0.52a
Short Fiber Index (SFI)	11.22±0.51a	9.26±0.34b
Elongation	5.67±0.23a	6.13±0.03a
Whiteness of color RD	78.33±0.18a	78.43±0.21a
Yellowness of color	8.20±0.05a	8.27±0.03a

*Means followed by the same letters against same year are not significantly different ($P < 0.05$)

Table 2. Effect of application of green manure, *S. bispinosa* on lint quality parameters of cotton during 2015

Lint quality parameter	*S. bispinosa*	Control
Spinning Consistency Index (SCI)	140.33±2.20a	145.33±0.72 a
Micronaire (MIC)	4.15±0.03a	4.12±0.02a
Fiber Maturity Index	0.86±0a	0.86±0.00a
Upper Half Mean Length (UHML)	1.07±0.005a	1.08±0.01a
Uniformity Index (UI)	82.43±0.08a	82.60±0.30a
Short Fiber Index (SFI)	10.47±0.19a	9.95±0.95a
Elongation	6.27±0.20a	5.83±0.20a
Whiteness of colour RD	79.50±0.30a	80.03±0.14a
Yellowness of colour	8.50±0.05a	8.30±0.05a

*Means followed by the same letters against same year are not significantly different ($P < 0.05$)

Figure 1 (a and b) shows comparative results of lint quality parameters of cotton during 2014 and 2015 as affected by the application of dhancha. According to results, significantly higher ($p < 0.05$) values of mic, maturity index were recorded during both when grown in dhancha treated plots as compared to control. However, higher uhml values were recorded in control treatments during both years in contrast to dhancha treatments. Comparatively, higher sfi values was recorded in dhancha treatment during 2014, however, it declines significantly during 2015 in dhancha treatment, but no difference in sfi values were recorded in control treatment during both years. Yellowness of cotton lint was significantly higher ($p < 005$) in control plot of 2014, but no difference was recorded in dhancha treatments of 2014 and 2015 and control of 2015. No significant difference ($p > 0.05$) was

Sci.Int.(Lahore),28(4),4109-4112,2016 ISSN 1013-5316;CODEN: SINTE 8

observed in the elongation values of lint between dhancha and control treatments during 2014 and 2015. Comparatively higher ($p < 0.050$ values of sci, unidex and Rd white were recorded for control treatments of 2014 and 2015 as compared to dhancha treatments during both years.

DISCUSSION

Bauer et al. (2009) observed significant impact of the application different green manures on yield and lint quality parameters of cotton as green manures provide readily available Nitrogen to cotton as compared to Urea. However, Bilalis et al. (2010) recorded similar pattern of yield and lint quality parameters of cotton with the application of organic and traditional methods. Another study in India showed that comparatively higher yield and lint of better quality was recorded in organic cotton as compared to modern methods of cotton cultivation (Blaise, 2006). Accordingly, all above mentioned results supported the findings of our study as comparatively better or with par lint quality cotton was recorded in green manure applied treatment as compared to untreated control.

CONCLUSION

Application of green manure has shown the capability to produce cotton with almost the same characteristics with traditional cultivation of cotton with additional improvement in SFI. This showed the advantage to cotton cultivation with green technology with less dependence on synthetic chemicals with potential to produce cotton lint comparable with traditional cotton.

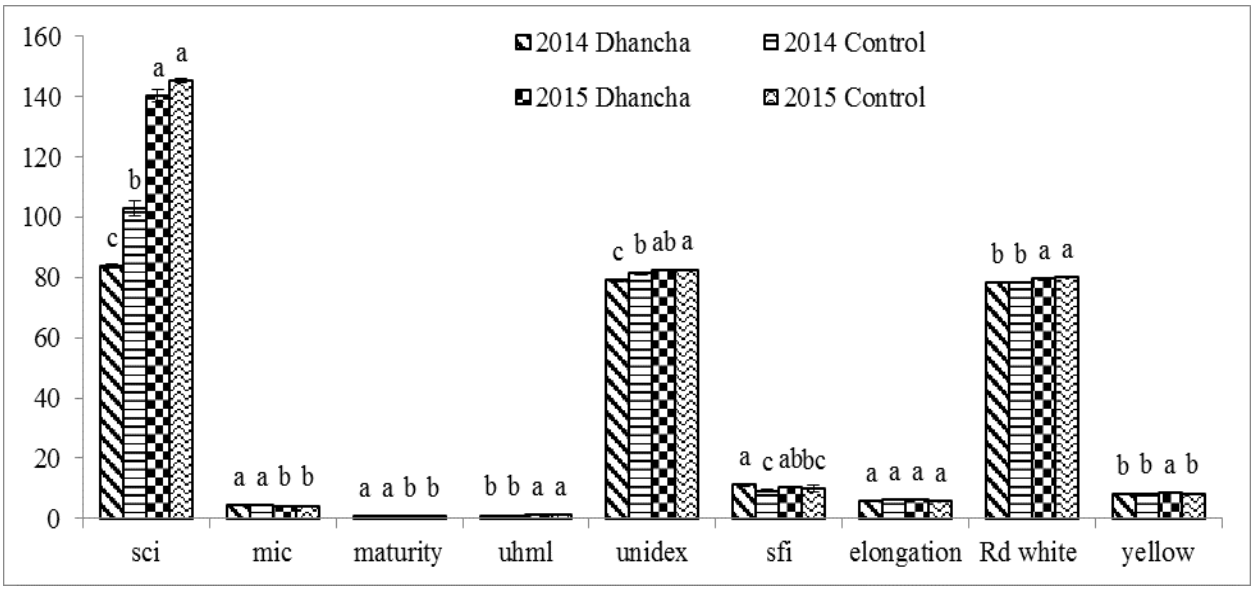

Figure 1: Effect of the application of green manure (dhancha) on various lint quality paramters of cotton

REFERENCES

[1] Avgoulas, C., L. Bouza, A. Koutrou, S. Papadopoulou, E. Kosmas, E. Makridou et al. 2005. Evaluation of five most commonly gown cultivars (Gossypium hirsutum L.) under Mediterranean conditions: Productivity and fibre quality. *J. Agron. Crop Sci*. 191:1–9. doi:10.1111/j.1439-037X.2004.00139.

[2] Bilalis, D., S. Patsiali, A. Karkanis, A. Konstantas, M. Makris, and A. Efthimiadou. 2010. Effects of cultural system (organic and conventional) on growth and fiber quality of two cotton (*Gossypium hirsutum* L.) varieties. *Renewable Agric. Food Syst.* 25:228–235. doi:10.1017/S1742170510000190.

[3] WWF. 1999. The impact of cotton on fresh water resources and ecosystems. A preliminary synthesis. Background paper. *World Wide Fund for Nature, Gland, Switzerland.*

[4] International Cotton Advisory Committee (ICAC). 1998. *World organic cotton production*, THE ICAC RECORDER, *Vol. IV, Decembre*.

[5] OTA. 2009. Organic cotton facts. *Organic Trade Assoc*. Updated February 2010.
www.ota.com/organic/mt/organic_cotton.html (accessed).

[6] Blaise, D. 2006. Yield, boll distribution and fibre quality of hybrid cotton as influenced by organic and modern methods of cultivation. *J. Agron. Crop Sci*. 192:248–256. doi:10.1111/j.1439-037X.2006.00218.

[7] Mygdakos, E., S. Patsiali, and G. Mygdakos. 2007. Economics of organic growing cotton versus conventional cotton under Greek conditions. *J. Food Agric. Environ*. 3:231–236.

[8] Bradow, J.M., P.J. Bauer, O. Hinojosa, and G. Sassenrath-Cole. 1997. Quantitation of cotton fibre-quality variations arising from boll and plant growth environments. *Eur. J. Agron*. 6:191–204. doi:10.1016/S1161-0301(96)02047-3.

[9] Deussen, H. 1986. Stressing high strength, low micronaire may require a rethinking of breeding and marketing methods. In: W. Spencer, editor, *Cotton International. 53rd ed. Meister Publ. Co., Memphis, TN*. p. 32–36.

[10] Christidis, G.V. 1965. The cotton. *Univ. of Thessaloniki*, Thessaloniki, Greece.

[11] Bauer, P.J., J.R. Frederick, J.M. Bradow, E.J. Sadler, and D.E. Evans. 2000. Canopy photosynthesis and fiber properties of normal- and late-planted cotton. *Agron. J.* 92:518–523. doi:10.2134/agronj2000.923518.

[12] Bauer, P.J., J.A. Foulk, G.R. Gamble, and E.J. Sadler. 2009. A comparison of two cotton cultivars differing in maturity for within-canopy fiber property variation. *Crop Sci.* 49:651–657. doi:10.2135/cropsci2008.06.0350.

[13] Davidonis, G.H., A.S. Johnson, J.A. Landivar, and C.J. Fernandez. 2004. Cotton fiber quality is related to boll location and planting date. *Agron. J.* 96:42–47. doi:10.2134/agronj2004.0042.

[14] Bednarz, C.W., R.L. Nichols, and S.M. Brown. 2006. Plant density modifies within-canopy cotton fiber quality. *Crop Sci.* 46:950–956. doi:10.2135/ cropsci2005.08-0276.

[15] Oosterhuis, D.M. 1994. Arkansas Experiment Station Special Report 166. University of Arkansas, Department of Agonomy, *Proceedings of the 1994 Cotton Research Meeting*. p. 31–40.

[16] Campbell, B.T., and M.A. Jones. 2005. Assessment of genotype x environment interactions for yield and fiber quality in cotton performance trials. Euphytica 144:69–78. doi:10.1007/s10681-005-4336-7.

[17] Wang, Y.H., X.H. Zhao, B.L. Chen, X.B. Gao, and Z.G. Zhou. 2012. Relationship between the N concentration of the leaf subtending boll and the cotton fiber quality. *J. Integrative Agric*. 11:2013–2019. doi:10.1016/ S2095-3119(12)60458-4.

[18] Read, J.J., K.R. Reddy, and J.N. Jenkins. 2006. Yield and fiber quality of Upland cotton as influenced by nitrogen and potassium nutrition. Eur. *J. Agron.* 24:282–290. doi:10.1016/j.eja.2005.10.004.