ABSTRACT

Cotton being a long duration and wide spaced crop having the habit of growing at slower rate in early stages and thus much of vacant interspace remains unutilized. It is indeed worthy to use land fully well by resorting to the introduction of intercrops. It has unique capacity to raise the unit profitability without unduly disturbing the cotton ecosystem. Intercropping of legumes (blackgram) is an important aspect for biological farming systems not only for weed control, but also reducing the leaching of nutrients, pest control and soil erosion. Inclusion of legumes as intercrop in cotton play a multi beneficiary role by providing grains and simultaneously it improves nitrogen status of soil through fixation of atmospheric nitrogen.

Key Words : Intercropping, Legumes, Weed control, Nutrient dynamics.

Intercropping in cotton

Intercropping in cotton has been recently recognized as potentially beneficial and economic system of crop production (Tomar et al., 1994). Similarly intercropping is one of the ways to increase the cropping intensity and resource utilization (Harisudan et al., 2008). Usually a yield advantage occurs as component crops differ in their use of resources when they are grown in combination; they are able to complement each other and make better use of resources.

Due to slow growing nature of cotton much of the vacant interspaces remains unutilized during initial stages of the crop growth. This situation offers ample scope for raising intercrops (Nehra et al., 1990). Similarly, this situation can be advantageously exploited for intercropping with short, early maturing pulses like blackgram, greengram and clusterbean (Muruganandam, 1984) which thereby improves the fertility status of soil.

Intercropping in cotton could exploit the environment in better way besides providing insurance against the inclement weather situation and consequent crops (Balasubramanian, 1987). Sivakumar (2003) observed increased productivity with higher market value and enhanced profitability when pulses were intercropped with cotton. Intercropping of legumes is an important aspect for biological farming systems not only for weed control, but also in reducing the leaching of nutrients, pest control and in reducing soil erosion (Prabu Kumar and Uthayakumar, 2006).

Legumes as intercrop component in cotton

Use of legumes as intercrop increased the fertility status of the soil particularly nitrogen and useful in saving fertilizer N (Balasubramanian et al., 1995). Legumes not only help in utilization of atmospheric nitrogen but also help in residual nutrient build up of
the soil (Madhavi Latha et al., 2004). Soybean being a leguminous crop adds organic nitrogen through its root nodules up to 250 kgs per hectare besides release organic acids, enzymes and cytokinin known for increasing the cotton yield (Kesavan, 2005). Enhancement of cotton yield is also possible by intercropping with short duration legume due to their complementary effect of fixing atmospheric nitrogen (Jayakumar et al., 2008).

**Blackgram as intercrop in cotton**

Cotton planted in paired rows and intercropped with blackgram resulted in increased yield and monetary returns (Janardhanan, 1982). According to Venkateswara Reddy et al. (1985) blackgram was observed as a compatible intercrop in cotton. Intercropping blackgram with cotton reduces weed incidence, pest incidence and as a result the yield attributes is increased which finally result in increased seed cotton yield (Jayakumar et al., 2008). Field investigation to study the effect of blackgram as intercrop in cotton reveal that cotton + blackgram intercropping has significantly increased the growth and yield of cotton (Harisudan et al., 2009).

**Effect of blackgram as intercrop on growth component of cotton**

Sanandachari et al. (1980) revealed that blackgram as intercrop suppressed the vegetative growth of cotton, up to 90 days. Reduction in growth in terms of plant height, leaf area index and dry matter at all the stages as blackgram was intercropped with cotton (Balasubramanian, 1987). Similar result on reduction of cotton growth was also recorded by Solaiappan and Dason (1998). On the contrary, plant height and dry matter of cotton were not influenced by intercropping of blackgram (Tomar et al., 1994). Wankhade (1994) had also concurred with this view that leaf area index, dry matter production and crop growth rate were not affected by intercropping either with blackgram or green gram.

Similarly, Musande et al. (1986) observed maximum plant height and leaf area index of cotton under cotton + blackgram intercropping situation as compared to sole cotton due to the restorative nature of blackgram.

Chellaiah (1996) reported that blackgram grown as intercrop encouraged the growth components viz., plant height, CGR of cotton, whereas, variation in plant height was not significant due to intercropping compared to sole cotton crop (Chellamuthu and Ramaswami, 2000).

Experimental results obtained by Kulandaivel et al. (2001) revealed that dry matter production of cotton at boll maturity was significantly higher in cotton + blackgram intercropping system than sole cropping of cotton. On the contrary, Sivakumar (2003) observed suppressive effect on the growth of cotton under cotton + blackgram intercropping system.

**Effect of blackgram as intercrop on yield components of cotton**

Number of bolls plant\(^{-1}\) was found to be similar between pure cotton and cotton + blackgram combination, but boll weight was higher in pure cotton as compared to any of the intercropping systems (Bavale and Vyahalkar, 1981). Jain et al. (1982) observed the beneficial effect intercropping of blackgram on cotton yield attributes.

Mukerji et al. (1987) recorded more number of fruiting points and number of bolls plant\(^{-1}\) under sole cotton whereas, boll weight was higher in cotton + blackgram intercropping system. More number of sympodia plant\(^{-1}\) and fruiting points plant\(^{-1}\) (Rajasekaran, 1988) were observed under cotton + blackgram intercropping systems.
Nehra et al. (1990) reported that there was no significant effect on yield attributes like number of sympodia plant\(^{-1}\), bolls plant\(^{-1}\) and boll weight due to the inclusion of blackgram or green gram with cotton. Maragathamani (1993) revealed that number of sympodia plant\(^{-1}\), fruiting points plant\(^{-1}\) and number of bolls plant\(^{-1}\) were higher in cotton + blackgram intercropping situations than sole crop.

Solaiappan et al. (1999) observed that blackgram as intercrop extended the fruiting duration and it reduced the number of sympodial branches plant\(^{-1}\), fruiting points plant\(^{-1}\) and boll weight.

Wankhade (1994) reported that the number of sympodial branches plant\(^{-1}\) and number of bolls plant\(^{-1}\) were found to be similar between sole cotton and cotton + blackgram intercropping conditions. More sympodial branches and higher boll numbers plant\(^{-1}\) were observed due to intercropping of blackgram compared to sole cotton (Chellamuthu and Ramaswami, 2000). Kulandaivel et al. (2001) pointed out that the boll weight of cotton was significantly higher in blackgram intercropped fields as compared to pure stand of cotton, while boll setting percentage was found to be similar in intercropped as well sole cropped field. But, reduction in yield attributes of cotton was noticed by Sivakumar (2003) as cotton was intercropped with blackgram.

**Effect of blackgram as intercrop on seed cotton yield**

Blackgram as intercrop caused slight reduction of seed cotton yield to the extent of three per cent and gave extra grain yield of 280 kg ha\(^{-1}\) (Bavale and Vyahalkar, 1981). Balkar et al. (1990) obtained seed cotton yield of 0.87 t ha\(^{-1}\) in cotton + blackgram intercropping system as against 1.04 t ha\(^{-1}\) in sole cotton. Nehra et al. (1990) reported that intercropping blackgram in cotton gave seed cotton yield of 7.4 q ha\(^{-1}\) which was 0.7 per cent less than the yield of sole cotton. Blackgram as intercrop reduced the seed cotton yield between 60 to 80 kg ha\(^{-1}\) as compared to sole crop (Solaiappan et al., 1999).

Nimbole et al. (1980) reported that blackgram as an intercrop had not reduced the seed cotton yield. Ved Singh and Chauhan (1981) found that there was no reduction in seed cotton yield when it was intercropped with blackgram.

Jain et al. (1982) observed an augmentation of seed cotton yield to a tune of 70 kg ha\(^{-1}\) with additional grain yield of 415 kg ha\(^{-1}\) of blackgram, when cotton was intercropped with blackgram. Venkateswara Reddy et al. (1985) reported that blackgram as companion crop had not reduced the seed cotton yield. Balasubramanian et al. (1994) reported that none of the characters including seed cotton yield were affected by intercropping with pulses and yield of cotton intercropped with blackgram was more or less equal to that of pure cotton.

Maragathamani (1993) recorded an increase in seed cotton yield in cotton + blackgram intercropping system. The yield increase in cotton was attributed to the complementary influence of blackgram through the addition of more available nitrogen to cotton. An increase in kapas yield with blackgram combination as compared to pure stand was observed by Krishnasamy et al. (1995). Increase in kapas yield was 15.7 per cent over sole cotton yield due to intercropping of blackgram (Chellamuthu and Ramaswami, 2000). Pest Incidence is less in cotton intercropped with blackgram which resulted in higher yield attributes and seed cotton yield (Jayakumar et al., 2008).

**Effect of blackgram as intercrop on quality parameters of cotton**

Rajeswara Rao and Sadapal (1982) noticed that quality parameters like ginning percentage, fibre length, fibre fineness,
maturity co-efficient and fibre strength in cotton were not influenced due to intercropping of cotton with blackgram, whereas, Chellamuthu et al. (1987) reported higher values of lint index and seed index in pure cotton as compared to cotton intercropped with blackgram.

Mukerji et al. (1987) also reported higher values of lint index and seed index in pure cotton as compared to cotton intercropped with blackgram and there was no significant difference on halo length and ginning percentage between cotton grown under pure stand and intercropping situation. Mukerji and Verma (1994) noticed no significant difference in ancillary characters and technological qualities of cotton due to inter cropping with crops like blackgram.

**Effect of blackgram as intercrop on nutrient uptake of cotton**

Satar et al. (1983) revealed that nitrogen content of cotton plant was significantly higher in cotton + blackgram intercropping owing to better N fixation by legumes, while phosphorus and potassium content of plants were not influenced by intercropping. Similarly, Brajdar et al. (1987) also indicated enhanced N uptake of cotton in cotton + blackgram inter cropping system. In controversy, Maragathamani (1993) revealed that N, P and K uptake of cotton was not influenced due to intercropping. Higher uptake of N and K by cotton was registered under pure stand as compared to intercropping. This might be due to increased dry matter yield without any interference from the inter crop components for resources (Solaiappan and Dason, 1998).

Chellaiah (1996) observed higher N uptake in pure stand of cotton at the initial stage as compared to N uptake under intercropping, but P and K uptake at all the stages were higher in sole crop. However, Kulandaivel et al. (2001) reported maximum N, P and K uptake under cotton + blackgram intercropping than sole cotton. This was ascribed to the more availability and absorption of nitrogen under blackgram intercropping situation. A field experiment at Parbhani reveal that uptake of NPK is higher when cotton was intercropped with blackgram than under soybean intercropping system (Giri et al., 2006).

**Effect of blackgram as intercrop on soil nutrient dynamics**

Mahasiram and Bhanu Rekha (2007) reviewed and revealed that blackgram a legume intercrop in cotton could enrich the soil besides meeting the grain and fodder requirement. Balasubramanian (1987) reported that higher nitrogen content of soil on 60th day under cotton + blackgram could be attributed to the release of nitrogen by the legume intercrop to the available soil nutrient pool. He also stated that these combinations recorded lowest available soil P as compared to sole cotton due to consumption of more P by intercrop. The nodulation effect of legumes resulted in higher residual nitrogen and organic carbon under blackgram intercropping (Raghavan, 1987).

The reduction in residual phosphorus in blackgram intercropping system was due to the depletion of P by higher – energy pulse crop (Solaiapppan, 1995). Chellaiah (1996) noticed that more available N in cotton + blackgram intercropping system than in pure crop of cotton. He opined that the increase was due to legume effect of blackgram, which might have supplied part of nitrogen to base crop. This resulted in lower demand of cotton crop for soil nitrogen leading to increased availability of N in cotton + blackgram intercropping.

The basic idea of intercropping is to grow two or more crops simultaneously at the same time and to exploit the resources much
better than sole cropping. Research evidences revealed that the blackgram as intercrop had enhanced the growth, yield and quality of cotton. In addition, many literatures have cited that blackgram being a leguminous crop with a characteristic of atmospheric nitrogen fixation had complemented the base crop through supply of nutrients. On the contrary, few research workers have found that blackgram had suppressed the growth and reduced the yield of cotton as compared to sole crop of cotton.

REFERENCES