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Research Article

Assessment of interspecific competition between *Abelmoschus esculentus* (L.) Moench and *Pennisetum glaucum* (L.) R.Br

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Abstract
Intercropping is practiced to maximise crops productivity and the, maximum use of the available resources of the plants. Usually, it is practiced for cooperation among the plants but plants also start competition with other plants. The stronger competitor may be more benefited. Therefore, care must be taken when intercropping is practiced. In this paper, interspecific competition between *Abelmoschus esculentus* L. Moench and *Pennisetum glaucum* (L.) R.Br. is reported. Various growth parameters were compared in monocropped and competitive conditions. The height of *A. esculentus* was less affected by *P. glaucum* when intercropped. The number of leaves and branches of *A. esculentus* were significantly higher in control as compared to competition. Number of flowers and fruits in *A. esculentus* were more in monocropped than for intercropped *A. esculentus*.

Keywords: Intercropping; Interspecific; Competition; *Abelmoschus*; *Pennisetum*

Introduction

Intercropping ensures efficient utilization of light and other resources, reduce soil erosion, suppress weed growth and thereby help to maintain greater stability of crops yield **[1]**. Intercropping is growing of two or more crops in close proximity to promote interaction between them and is practiced with the aim of maximizing plant cooperation rather than plant competition for maximum crop yield per unit area **[2]**. Plants need nutrients, water and sunlight CO_2 and O_2 for their growth and reproduction processes. Nutrient and water present in the soil where from they are absorbed by the plant roots. Sunlight, CO_2 and O_2 are taken from the atmosphere. When plants grow together they compete for all these resources. Competition is a harmful hindrance of one individual over another **[3, 4]**. Grime **[5]** argued that best competitors are those species with characteristic traits having maximum competitive effect. Tilmen **[6]** elaborated that a good competitor has maximum competitive ability and to tolerate the depleted resources level. Clements *et al.* **[7]** pointed out that two plants compete whenever the available resources are

deficient in the environment. Plants compete for water, nutrients, space, light etc and their environment will determine which species will make their existence [8]. There are two types of competition; intraspecific competition and interspecific competition. Intraspecific competition is mainly violent because plants of the related species have equal requirements and similarity in obtaining same resources [9]. Competition occurs not only within individuals but also within and among growth periods of different individuals [10-13]. Competition is related to age of plant but germination, emergence, primary root and shoot growth maybe mostly susceptible to competition [14-16]. Greater success in competition is typically expected for larger plants as they are likely to be better equipped to capture resources and more effective at denying resources to other plants [17].

Materials and methods

Field experiment was performed in botanical garden Islamia College Peshawar, to investigate the interspecific competition between *P. glaucum* L. and *A. esculentus* L. Six plots of 1×2m were prepared for the experiment. The plots were frequently watered so as to leach out any possible biochemical substances.

A. esculentus L. and *P. glaucum* L. were grown alone in plot 1 and 2 respectively whereas in plot 3, 4, 5, and 6 *A. esculentus* L. and *P. glaucum* L. were grown together. Intercropping was done in such a way there was one intercrop row between two adjacent *P. glaucum* L. rows. Inter row distance was kept 10 cm [18]. Five plants from each plot were selected randomly to calculate data for various vegetative and reproductive growth parameters. The plants were selected from the middle rows of plots so as to ensure the maximum competitive effects. Data of different parameters was taken at interval of 10 days. The crops were irrigated at regular intervals. Uniform quantity of water was supplied according to all the plots. All other conditions such as light and temperature etc. were also kept uniform.

Results and discussion

Abelmoschus esculentus L. Moench was domesticated in west and central Africa but is now widely cultivated throughout the tropics primarily for local consumption [19, 20]. In Nigeria, it ranks third in terms of consumption and production area following tomato and pepper [21]. The immature pods are used as boiled vegetable while in dried form it is used as soup thickener [22]. The green pods are rich sources of vitamins, calcium, potassium and other minerals [23]. Retta *et al.* [24] argued that *P. glaucum* L. is probably originated in West Africa and is now extensively cultured in diverse parts of the earth. Theunissen [25] proposed that *P. typhoides* is of immense significance in the semi infertile tropics. The advantages of intercropping include greater system resilience by the interplay of different crops [26, 27], greater production at crop edges [28], reduce insect pest incidence, reduce disease transfer [29], and delivers environmental benefits such as greater soil and water conservation potential [30]. Most intercropped research has focused on field crops such as *Zea mays* L., *Glycin max* L., *Vicia faba* and Sugar beet [31, 32]. Intercropping field and vegetable crops has also been intensively investigated [33, 34]. However, relatively few studies have addressed vegetable plus vegetable intercropping system. During last decades, relatively few studies were conducted on cultivating okra in multiple cropping systems. Majority of these studies were particularly concerned with intercropping okra with major field crops as maize, rice, soyabean and sunflower [35, 36].

A field experiment was conducted to study interspecific competition between *A. esculentus* L. and *P. glaucum* L. The height of *A. esculentus* was less affected by *P.*

glaucum L (Figure 1B). Similar results were shown by Olasantan [37] by Intercropping *A. esculentus* and *Zea mays* L. This might be due to competition between these two crops for available resources. Besides nutrients there might be some chemicals released by one plant that inhibit growth and nutrients absorption of other plant.

Number of flowers and fruits were also more in monocropped *A. esculentus* L. than for intercropped *A. esculentus* L (Figure 2B and 2C). This view was also supported by who reported that greater number of pods produced for monocropped *A. esculentus* could have been influenced by greater number of branches and leaves per plant. This view was also supported by who reported that number of pods would depend on the intensity of growth of plant.

The number of leaves and branches of *A. esculentus* L. were more in control as compared to in competition (Figure 1A and 2A). This might be due to shading effects of *P. glaucum* on *A. esculentus*, because light is an important factor in competition to determine the leaf area [38]. Decrease in leaf growth may be due to the competition of roots for absorption of nutrients from the common rhizosphere. Distribution of root might affect the root and shoot ratio and consequently affected the efficiency of using moisture and nutrient resources [38-40].

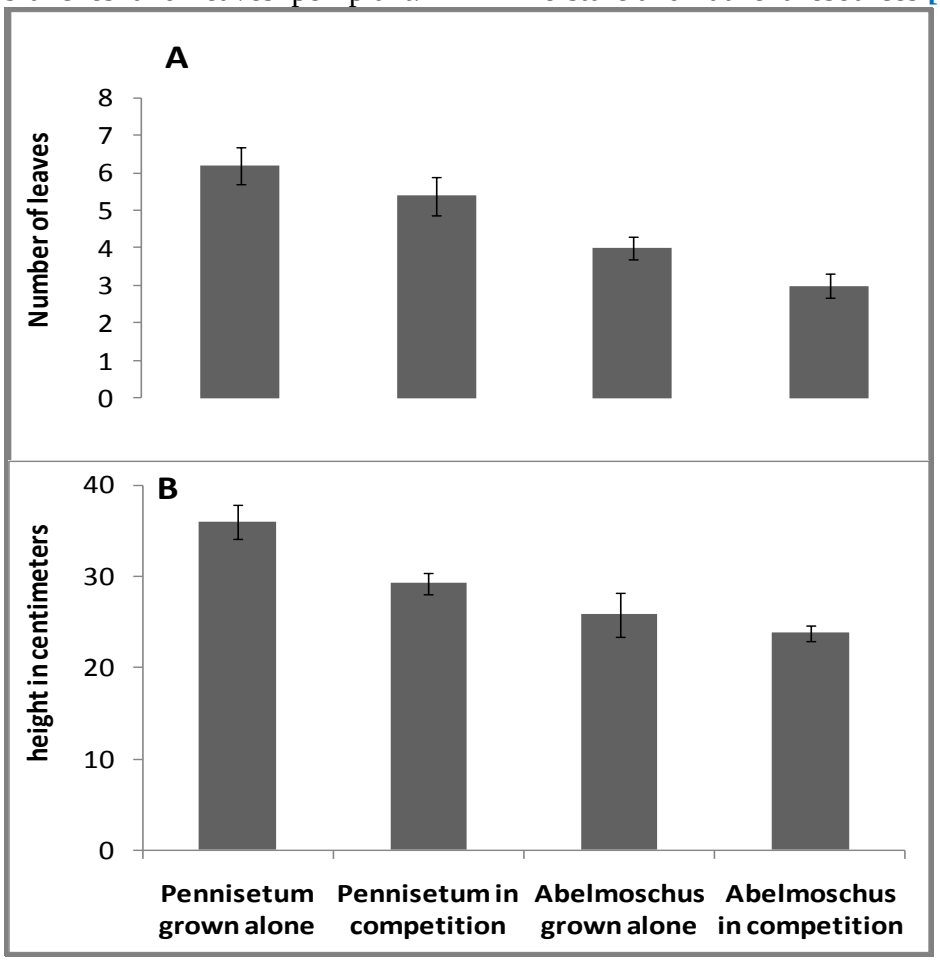

Figure 1. Interspecific competition between *A esculentus* and *P glaucum*. Figure 1A represents number of leaves and Figure 1B represents height. Six plots of 1×2m were prepared and plants were grown separately and in competition. Errors bars represent the standard errors

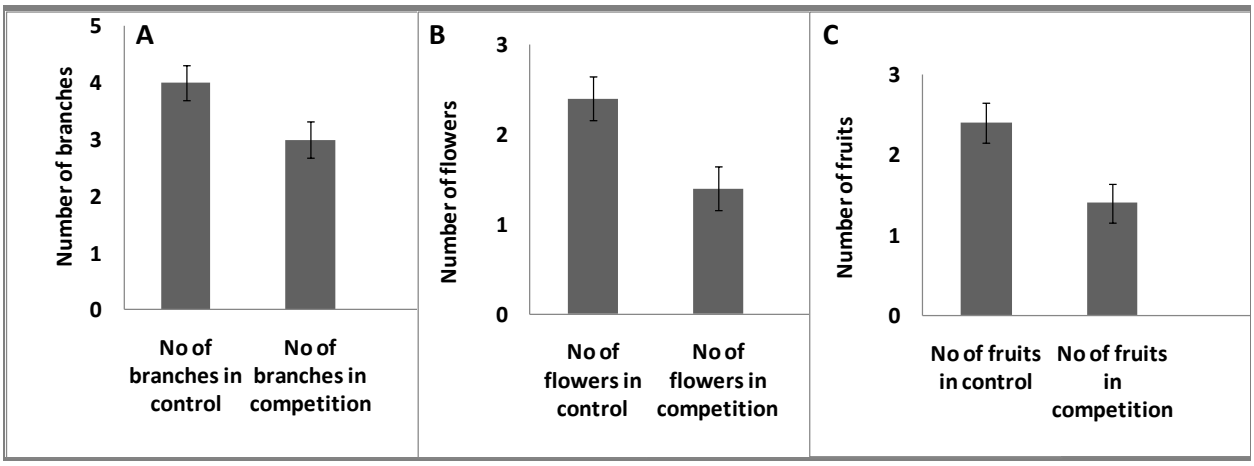

Figure 2. Interspecific competition between *A. esculentus* and *P. glaucum*. Figure 2A represents number of branches, Figure 2B represents number of flowers and Figure 2C number of fruits. Six plots of 1×2m were prepared and plants were grown separately and in competition. Errors bars represent the standard errors

Conclusion

It is concluded that interspecific competition between *A. esculentus* L. Moench and *P. glaucum* (L.) R.Br. affects the growth of both the plants. Hence *A. esculentus* and *P. glaucum* will give better yields in monocropped condition than in competition.

Authors' contributions

Conceived and designed the experiments: SZ Shah, SA Taskeen & I Ahmad, Performed the Experiments: SA Taskeen & S Wali, Analyzed the Data: I Ahmad, S Wali & SA Taskeen, Contributed reagents/ materials/ analysis tools: SZ Shah & I Ahmad, Wrote the paper: I Ahmad, S Wali & SA Taskeen.

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