EFFECT OF PLANTING DATES AND POTASSIUM FERTILIZATION ON GROWTH AND PRODUCTIVITY OF SOME BROCCOLI CULTIVARS IN SANDY SOILS

By

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1. INTRODUCTION

Broccoli (*Brassica oleracea* var. *italica* plenck) is an annual crop which reached maturity in about 75 to 95 days, depending on cultivar, season and planting date. The whole immature inflorescence (head) is the edible portion, with the floret tissue most often being consumed. It could be an important vegetable crop for local consumption and exportation. The higher prices of its heads could be profitable for vegetable growers. The recent increase in broccoli consumption as well as in transportation introduce broccoli to cover more area in the vegetable rotation. Although, broccoli known and used in the American and European countries for many decades, it had not gained the same attention in Egypt. One reason could be related to the lack of information about its nutritive value (**AboulNasr and Ragab, 2000).** Broccoli is highly nutritious and has been deemed as anti-cancerous food by the American Cancer Society. It is a good source of vitamin A, calcium and vitamin B2 **(Sanders, 1996).** Broccoli buds were found to be a rich source of most minerals especially of K, S, P, Mg and micro-elements **(AboulNasr and Ragab, 2000).** More attention may be paid for studying its planting dates, cultivars, fertilization, irrigation and the other growing factors in Egypt. Broccoli is a new crop in Egypt. Only few studies have highlighted the complex and interrelated effects of cultural practices and environmental conditions on broccoli production (**Diab, 2003; Metwally, 2006 and El-Helaly, 2006).**

Broccoli is a cool-season crucifer. It has about the same climatic requirements as cauliflower. It is well adapted to all areas when grown during the coolest months of the year, although, it is not as sensitive to hot weather. It is harvested over a longer period of time than cauliflower since lateral broccoli shoots develop marketable heads after the main head are harvested (**El-Helaly, 2006**). Planting dates suiting local consumption and exporting needs must be studied. In addition, many cultivars may be evaluated under the new reclaimed soils in Egypt. Very little information is available on the specific requirements of broccoli fertilization in Egypt, especially in newly reclaimed land. So, this investigation was carried out

on potassium requirements for improving green yield and qualities of broccoli head, grown in sandy soil are discussed. Potassium is necessary in young growing tissues for cell elongation and possibly for cell division. Potassium is very mobile in plants and therefore circulates freely and has vital role in maintenance of torpor pressure. It also helps in several physiological processes and uptake of other nutrient elements **(Sadanandan *et al.,* 2002).** To successfully grown broccoli plants in the newly reclaimed soils, many factors have to be considered, such as using the right cultivars, suitable transplanting date, fertilization, compensating for the low amounts of available nutrients and low organic matter content as well as poor hydrophilic, chemical and biological properties. The best means of maintaining soil fertility and productivity could be done through periodic suitable rate of potassium fertilizer.

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2. REVIEW OF LITERATURE

2.1 Effect of planting dates

2.1.1. Effect of planting date on vegetative growth characteristics:

Vegetative growth of broccoli plants was widely affected by the environmental conditions during its growth season. Many investigators dealt with the relationships of its growth and air temperature, light duration and humidity which are related to date of sowing.

Fontes *et al.* (1967) reported that under glasshouse conditions low temperature reduced growth of broccoli plants compared with higher temperature. At the same time, **Gauss and Taylor (1969)** mentioned that under glasshouse conditions high temperatures increased growth of broccoli plants compared with lower temperature.

Chung (1985) reported that delaying in sowing time from December to January and March reduced significantly total dry matter of broccoli plants.

Chung and Strickland (1986) found that sowing dates from November to January had little effect on plant size and delaying sowing from January to March reduced the plant size of ten broccoli cultivars of different maturity types.

Butt *et al.* (1988) reported that the highest number of cauliflower leaves per plant at harvesting time was obtained from the latest planting date (20^{th} October).

In New Zeland**, Diputado and Nichols (1989)** reported that total dry matter production of broccoli plants varied with sowing dates. It was lower during winter than during summer. The variation in plant potential for dry matter production with sowing dates reflected differences in temperature regimes, although other environmental parameters, especially solar radiation might have important influence too.

Latimer (1990) reported that stem length of broccoli plant was affected by seasonal or environmental conditions. In addition, the growth and development of cauliflower plants were sensitive to environmental

conditions as illustrated by the number of leaves formed before curd initiation **(Wurr and Fellows, 1990).**

Wurr *et al.* (1990) found that number of leaves of cauliflower varied between transplanting dates where number of leaves was greater from the July transplanting (mean temperature 17.5˚C) than from transplanting in March, May and June (respectively, 8.3, 11.7 and 15.4˚C).

Kryuchkov and Suddenko (1991) indicated that early sowing (5th and 20th April), reduced the number of leaves on central stem of cabbage plant comparing with late sowing (5th and 20th May).

In Canada, **Toivonen *et al.* (1994)** working on broccoli plants suggested that the highest value of dry matter was recorded, in the first December planting date and followed by first November and then first October.

Ghanti and Mallick (1995) tested the influence of planting time on stem growth in early cauliflower. Six early cauliflower cultivars were transplanted during different summer months. Stems were longest in August- transplanted crops and in Early Market and Hot Season cvs.

Ashok *et al.* (1995) using ten cultivars of different maturity groups of cauliflower, planted at monthly intervals from 31st March to 15th May and reported that early plantings recorded large- sized leaves.

Klaring (1998) showed that increasing temperature accelerated leaf expansion of broccoli plants as well as increased plant size.

Grevsen and Olesen (1999) reported that the leaf appearance rate in broccoli plants is described by a linear relationship to number of leaves and air temperature. The temperature response of leaf appearance rate had a base temperature of about 2 to 3˚C, depending on cultivar, and showed no indications of having a temperature optimum below 20˚C. The leaf appearance rate increased with plant age and temperature and there was no indication of a relative low temperature optimum for leaf appearance rate.

Hassan (1999) reported that leaves weight of broccoli plants was affected significantly by transplanting dates. There was remarkable reduction in the number of leaves per plant in the first year with delaying the transplanting date from first October to first December. However in the second season, number of leaves per plant declined when plants were transplanted on first October as compared with first September, but it increased again when transplanting was delayed to first November. The earliest transplanting produced the heaviest stem weight. This was also true in all cultivars in both seasons except sprouting broccoli Create cv. There were significant differences in stem diameter and stem length as affected by transplanting date.

Singh *et al.* (1999) mentioned that maximum plant height of broccoli plants was recorded following transplanting on 27th of October compared with planting on 20th of October and 3st of November.

Singh (2001) found that the highest average values for plant height (41.75) cm of broccoli plants was recorded when the crop was transplanted on 27th October compared with planting at weekly intervals from 20th October to 22nd December.

Pankaj Srivastava *et al.* (2002) mentioned that plant height of cauliflower plants increased, whereas number of leaves per plant decreased with delay in planting.

Ahmed (2003) reported that, in broccoli cultivars Calabria and Emperor, number of leaves after 4 and 8 weeks from transplanting was significantly affected by transplanting dates. In addition, the best vegetative growth of broccoli was obtained with the sowing of mid September compared with the sowings of mid October and mid August **(Gomaa, 2003).**

Abd El Kader (2003) found that sowing dates had a significant effect on plant height, number of leaves and stem diameter of broccoli plants. It was noticed that transplanting on 15th of September or 1st of October increased the plant height, number of leaves per plant and stem diameter of vegetative growth.

Similarly, **Diab (2003)** reported that the second transplanting date (23rd October) gave the highest value for plant fresh and dry weight, number of leaves per plant and plant length to the tallest leaf compared with the first transplanting date 8th October and third transplanting date 7th November in broccoli plant.

Ahmed and Wajid Siddique (2004) indicated that sowing on 5th May produced more leaves, taller plants of broccoli cv. Green Mountains compared to other sowing dates (20th April, 20th May and 1st June).

In addition, **Jamil and Siddique (2004)** reported that sowing broccoli on 5th of May produced plants having the highest values of height and leaf length. Results on various parameters showed that maximum growth was obtained by planting broccoli cultivar Green Mountains on 5th of May.

Emam (2005) found that early planting (22nd August) in broccoli plants increased plant height, number of leaves/plant and main stem diameter. However, no significant differences were detected between the two planting dates (22nd August and 23rd September) in the first season; significant differences were found in the second season.

Hassan *et al.* (2006) reported that early planting of broccoli on 15th of August resulted in a significant increase in plant dry matter and plant height in both seasons. This treatment resulted also a significant reduction in total number of leaves in both seasons. The third planting date on 15th of October increased total number of leaves significantly compared with 15th of August and 15th of September.

Metwally (2006) indicated that sowing broccoli seeds cv. Emperor on the first of October was the most favorable for stimulating the vegetative growth of plants compared to the other tested sowing dates.

El-Helaly (2006) working on broccoli, found that 15th October plantation had the highest number of leaves compared with 15th August and 15th September. However, the first planting date 15 August had the highest plant height compared with the other two tested planting dates. He added that total plant dry matter and leaf dry matter content of broccoli

plants were significantly the highest in the first planting date (15th August). On the contrary the third planting date (15th October) gave the lowest value in this respect in both seasons.

El-Yazied *et al.* (2007) mentioned that planting broccoli in the first of October produced the tallest plants and the highest number of leaves per plant compared with each first of September and November.

Muhammadin *et al.* (2007) showed that planting cauliflower at 16th June statistically showed maximum fresh plant weight compared with other planting dates (1st June, 1st July, 16th July and 31st July).

Preeti Singhal *et al.* (2009) reported that plant height in broccoli plants was greatest with planting on 14th November on the first year, and planting on 1st , 15th and 30th October in the second year.

2.1.2. Effect of planting date on head yield:

Many investigators dealt with the relationship between time of plantation and the yield of broccoli heads and their quality. Most investigators found that delaying broccoli plantation reduced the head yield.

In New York, **Skapski and Oyer (1963)** showed that later sowing gave significantly lower yield of cauliflower.

Salter *et al.* (1984) indicated that maximum fresh weight yields of trimmed heads in broccoli plant were decreased by delaying planting from January to March. Yield, maturity and quality were affected by environment. The late sown crop, for example, gave a lower yield.

Chung (1985) found that delays in the sowing date from December to January and March considerably reduced marketable spear yield of broccoli from 15.6 t/ ha to 10.5 t/ha and 5.7 t / ha, respectively.

In Australia**, Chung and Strickland (1986)** reported that sowing after February reduced the spear yield for all broccoli cultivars, compared with earlier sowing. It is suggested that the lower growing temperatures of later sowings might cause floral initiation at a younger physiological age. Plants therefore develop heads before reaching full size and the spears are small and take longer to reach maturity. A production schedule