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Effect of abiotic factors on sun flower (*Helianthus Annuus* L.) seed germination, seedling growth and oil content

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ABSTRACT

The study was carried out to estimate the significance of sun flower seeds germination at different temperature and water treatment. Germination % seedling growth, moisture content was studied. Present studies suggest that 25^{0}C – 35^{0}C temperature and alternate day water treatment results better germination percentage and healthy seedling. Maximum root / shoot length and moisture percentage were also good at 25^{0}C. Maximum oil content was found in those seeds which germinate at high temperature. It is concluded that for Sun flowers seeds better grow at 25^{0}C – 35^{0}C and alternate day water treatment results in better yield.

Key words: Abiotic factors, Sun Flower, Germination, Seedling Growth, Oil content.

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is an important ornamental member of the family Composite. It has as economic importance world wide as oil content, and is considered as second most important oil seed crop of the world [1]. Pakistan is basically an Agricultural state and spends millions of dollars on the import of oil. The local oil production of the country cannot provide sufficient amount for the populatio [2]. To meet the requirement of edible oil seed crop, sun flower crop was introduced in Pakistan as an oil yielding crop in late seventies and was planted over 25,899 hectares in Pakistan[3]. Sunflower seeds contain 25-32 % edible oil, which are a rich source of polyunsaturated fatty acids, used for human consumption [4]. This ornamental plant is also used as fodder crop in most of the Asian countries, where it is fed green or converted into silage. In view of their economic significance sunflower oil seed cultivation could be exploited as potential source of edible oil.

For the growth and establishment of sunflower plants, temperature is a major factor that effects on growth and germination of crop species [5-7]. Cultivation of vegetation has direct relationship between the number of emerged seedlings and establishment of seedling has prime importance [5]. There is little information available on sun flower

plants germination related to temperature treatment and correlation between seed size, seedling growth and oil extraction from seeds of Quetta.

MATERIALS AND METHODS

Seed collection and preparation

Seeds were stored at room temperature these were obtained from Agriculture department, Government of Balochistan. Hyssium 33 (seeds) was used for studies and sterilized with mercuric chloride. Morphology of hundred seeds was also studied under binocular microscope (40 x magnifications) seed length / width, color, shape and weight was observed.

Temperature treatment

Seeds were placed at 5^{o}C, 15^{o}C, 25^{o}C and 35^{o}C in 9 cm diameter Petri plates containing whatman filter paper no 41. Ten ml distill water was used for the treatments. At the same temperature a set of three replicates of Petri plates were watered at alternate days.

Different parameters such as germination percentage, total plant height, root, shoot length, leaf length and width ratio, fresh weight and dry weight of seedlings, moisture contents was observed. All treatments consist of three replicates of 25 seeds and compared with control treatment which was kept at 25^{o}C. Protrusions of radicals were considered as marks for germination [8]. The number of emerged seedling in each Petri plates was counted daily up to 30 days. Oil was estimated by the method of [9]. Significance of result was checked at certain level of probability.

RESULTS AND DISCUSSION

Seed morphology

Seeds were more or less spherical, average length was about 0.8 mm long while the breadth was 0.5 mm. Seeds were elongate, narrow at the top and oblong shaped. It has hard brittle test, seed surface are roughly smooth and black brown in color.

Seed weight varied greatly among samples ranges from 0.8 - 0.83 gm.

Effect of temperature and water treatment on germination

Initially at 5^{o}C late emergence of seeds (7 days) were observed and germination was 16%, while at 15 ^{o}C and the seeds start to protrude on the fifth day after soaking in Petri plates and the germination was 80 %. Maximum germination (92 %) was recorded at 25^{o}C, while three to five days were required for initial germination. Seventy five percent (75 %) germination was found at 35^{o}C and the seed require 4 days for initial germination, in control treatment maximum best germination 80 % was observed. Seed germination was greatly affected by the change in temperature. Similar responses in germination under high temperature were reported by [10, 11]. For other species. The seed germination was faster at high constant temperature and resulted in maximum germination percentage.

Compared to higher constant temperature treatment, lower temperature and alternate day water treatments, reduce germination time and percentage on the number of emergence of seedlings The lower temperature treatment significantly delayed the germination; Daily water treatment showed medium germination % at 15 ^{o}C and 25 ^{o}C, that was 60 % and 40 % respectively. Highest final germination percentage (96 %) was recorded in all treatments and was observed in 30 days. So it is suggested that best possible treatment for germination is 25 ^{o}C and alternate day water treatment. It has also been found increase or decrease in germination rate with the increase in seed size depending on condition. Seed size also effect on germination percentage and seedling size (Hendrix S. D 1984) [12]. However, germination percentage was not affected by seed size in *Agropyron bsammophilum*, decrease seed weight can be disadvantageous [13, 14].

Total plant height, root / shoot length

Maximum length 20cm (9 x11; R / S length was recorded at 5 ^{o}C and 15 ^{o}C in controlled treatment, while 18 cm (8 x10 R / S length) was observed at 35 ^{o}C and 17 cm mean length of seedlings was found at 25 ^{o}C in control treatment. While daily water treatment showed maximum length of root / shoot ratio, it was 24 cm (11 x13) at 35 ^{o}C, however, at 25 ^{o}C average 23 cm of seedlings was noted. Average 17 cm and 19 cm seedling length was noted at 5

^{o}C and 15 ^{o}C respectively. Root shoot lengths in our studies were maximum in control treatment at 25 ^{o}C. It has been reported direct relationship between seed size of *Triticum aestivum* L and the seedling shoot and root weight [15]. Furthermore, studies relationship between seed size and survival and to some extent controlled for genetic versus environmental effects, by comparing the effect of seed size differences within and among three species of *Sesbania* [16].

Leaf length and width ratio

Result showed that leaf length and width ratio varies, at 15 ^{o}C temperature maximum length and width ratio (3.4 /1.7 cm) was found. At 25 ^{o}C treatment 3.4 /1.6 cm length and width ratio was observed, while in control treatment 2 /1.6 cm length and width ratio was noted at 5 ^{o}C. Alternate day water treatment resulted maximum length / width ratio (3.4 /1.6 cm) at 25 ^{o}C. In controlled treatment similar results were found with daily water treatment, it was 2 /1.3 cm length and width at 25 ^{o}C. While at 35 ^{o}C showed maximum length width ratio 3.4 /1.7 in alternate water day treatment.

Fresh Weight/Dry Weight and Moisture Content

Observations of result showed that in controlled treatment maximum fresh weight of plant 6.4 mg, dry weight 4.9 mg was found at 5 ^{o}C while moisture percentage was 22.34. In temperature treatments highest fresh weight 4 mg and dry weight 2.5 mg was noted at 5 ^{o}C, comparable with controlled treatment while the moisture percentage was 33.33.

At 35 ^{o}C mean 0.2, 0.1 mg fresh wet and dry weight was noted while the moisture percentage was 50 %. However, daily water treatment resulted 6.4 mg fresh weight, 4.97 mg dry weight and moisture was 22.34 % at 15 ^{o}C, while at 35 ^{o}C results highest fresh weight 4 mg, 2.5 mg dry weight with daily water treatment and the moisture content was 37.5 %. The increases shoot and root length as well as fresh weight and dry weight of seedlings increases in size at 25 ^{o}C temperature. Similar observation was concluded by (Wajid A. S. Shaukat 1993; Shaukat S et al. 1999) [17, 18]. The significance of seed weight variation in a species depends on both the timing and magnitude of any seed weight also effects on seedling size and competitive ability [19]. Thus variation in seed size has greater ecological significance in the establishment and maintenance of population.

Extraction of oil

The oil extracted from 50 gm sun flower seeds ranges between 40-60 %. At 25 -35 ^{o}C temperature maximum yield of germination %, best seedling growth, maximum fresh weight and dry weight and high % of oil was calculated from sunflower seedlings. Although some plants germinate only at relative high temperature so, to complete the requirement of edible oil the sunflower seeds can grow on commercial basis at the temperature ranges between 25 - 35 C^{o}. Oil is used in human diet so, there is need to ensure that seeds sold in market are free of cost and free from germs. It has a wide range of adaptability, and yield of sunflower depends on the quantity of water available at the stage of intensive growth.

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