Pak. J. Sci. Ind. Res. 2004 ***47*** *(5) 376- 379*

SOME ECOLOGICAL STUDIES ON *LINUM USITATISSIMUM* LINN

Nadia Imtiaz[a], Farrukh Hussain[a], Ghulam Dastagir[a] and K M Aslam[b*]

[a]Department of Botany, University of Peshawar, Pakistan

[b]Department of Botany, University of Azad Jammu and Kashmir, Muzaffarabad, Pakistan

(Received July 11, 2002; accepted August 13, 2004)

The application of fertilizers appeared to have no significant effect on the overall growth and productivity. Various salt types affected various parameters with a tendency of better growth in light textured soils. The plant grew better in full light condition with optimal soil moisture. The plants wilted to death under shady condition. Both the water stressed and waterlogged conditions reduced the growth performance but the waterlogged condition adversely affected the plants. Therefore, it is concluded the *L. usitatissimum* could be grown in semi-arid condition on marginal lands.

Key words: *Linum usitatissimum,* Soil moisture, Growth, Productivity.

Introduction

Linum usitatissimum Linn. (Family Linaceae) a medicinal plant has various names such as linseed, flaxseed, common flax, flas, lint (English); alsi, alish, tisi (Punjabi and Urdu); Bazarug, kuman, kuta, tukhme-katan, zaghir, zaghu (Persian). It has many medicinal and other uses (Khan 1969; Khan 1970; Sahid Leitch 1994). Its seeds are used as demulcent in catarrhal complaints and acute or chronic gastritis. Powdered seeds are used as an emollient in poultices for boils, carbuncles, festering sores and other skin affections. The seeds contain galactose, arabinose, rhamnose, xylose, galacturonic and manuronic acids; 30-49% fixed oil, 25% protein, sterols, trilierpenes, 0.1-1.5% cyanogenic glycosides and monoglycosides (Bissent 1994). The cultivation of linseed has several advantages for arable farming interms of profitability, expanding demands and adaptability of the crop to various soil types and seasons. Several workers have made studies on its cultivation (Smid 1998) and under different soil moisture levels (Teo *et al* 1989; Lambert *et al* 1990; Singh and Sharma 1991; Ranney and Bir 1991). The present study was conducted to see the effect of different soil types, light conditions, fertilizers and water levels on the growth performance of this plant.

Materials and Methods

Seedlings of *L. usitatissimum* were raised in nursery beds with loamy soils on October 30, 1998. At an average height of 5 cm, 10 seedlings were transplanted to equal size (18 x 22 cm) pots containing loamy soil. After 7 days, they were thinned to 5 uniform seedlings per pot. There were 5 replicates for every treatment in each of the experiments. In all the experiments loamy soil was used except where the effect of soil type was to be investigated. Weeding was done by hand. The pots were maintained at field capacity (Hussain *et al* 1989) during the experimental period except in experiment where the water and different levels of soil moisture was tested.

To see the effect of soil types plants were grown in similar pots with equal volume of sandy, clayey or loamy soils. The pots were kept in open uniform condition in net house and maintained at field capacity (Hussain *et al* 1989). The effect of fertilizers was determined by applying urea, diammonium phosphate (DAP) and organic matter in each pot following Jalis and Khan (1982). The organic matter was added @ of 0.05% to each pot. The pots were placed in full sunlight, partial light and shade to see the effect of different light conditions (Mubarak *et al* 1983).

To determine the effect of soil moisture on plant growth the pots were maintained at field capacity (control condition), water stressed and waterlogged condition. Initially all the pots were saturated. The water stress was created by withholding the water till the temporary wilting was evident. They were rewatered and again allowed to reach the temporary wilting point. In this way four stress cycles were run. Pots subjected to waterlogging were kept saturated all the time.

In all the experiments, the data on growth behaviour such as number of leaves, branches, height of plants, number of flowers, number of fruits and seeds were taken on April 20, 1999. The amount of total chlorophyll, a and b of shoots was determined following the method of Hussain (1989). The results were subjected to t-test.

* Authors for correspondence

Table 1

Effect of different ecological condition on the vegetative growth performance of *L. usitatissimum*. Each value is an average of 5 replicates, each with 5 plants

Growing condition	Height (cm)	No. of leaves	No. of branches	Fresh weight (g)		Dry weight (g)		Moisture contents (%)	
				Shoots	Roots	Shoots	Roots	Shoots	Roots
a. Effect of soil type									
Sand	39*	48*	21	2.26*	0.33	1.62	0.20	40*	65*
Clay	48*	45*	25	2.44	0.34	1.56	0.20	56*	70*
Loam	48	49	20	1.99	0.38	1.50	0.27	33	41
b. Effect of fertilizer									
Control	44	60	26*	2.00	0.29	1.60	0.16	25	81
Urea	35*	49	11	1.41*	0.22*	1.00	0.15	41*	47*
DAP	49*	69*	27*	1.37*	0.22*	0.99*	0.13	37	69*
OM	40	60	19	1.21*	0.27	0.86*	0.16	41*	69*
c. Effect of different light condition									
Full light	53*	55	27	1.67	0.30	0.99	0.18	69	67
Partial light	41	49	19	0.86*	0.20	0.66*	0.13	30	54
Shade	--	--	--	--	--	--	--	--	--
d. Effect of different levels of soil moisture									
Field capacity	49	69	30	1.46	0.21	1.09	0.11	32	91
Water stress	32*	19*	23	0.45*	0.11	0.35*	0.06	29	83
Water logged	19*	12*	12	0.37*	0.04	0.27*	0.02	37	100

DAP and OM, respectively diammonium phosphate and organic matter. * Significant at P=0.05.

Results and Discussion

Effect of soil types. The plant height was minimum (39 cm) in sandy soil (Table1). The least number of leaves were observed in clay soil while the number of branches were more in clay soil. The fresh and dry weight of shoots and roots was slightly high in sand and clay soil. The moisture content of shoots and roots was slightly high in clayey soil (Table 1). The total chlorophyll and chlorophyll a and b were generally high in plants growing in clayey (Table 2). The number of fruits/plant and seeds/plant were high in loamy soil (Table2). Samui *et al* (1995) also reported better growth of plants in clay, sandy and loamy and the present findings agree with them. Similarly, Guadchau and Marquard (1995) and Khodyankora (1995) reported that flax grew better in sandy and loamy soil. The present findings show that the number of branches and chlorophyll contents were greater in clayey soil suggesting its suitability for the growth of *L. usitatissmum* and this agrees with findings of Connor (1994).

Effect of fertilizer. Although the application of DAP enhanced the height, number of leaves and number of branches but plants had greater fresh and dry weight of shoots and roots in control (Table 1). The plants grown in control and DAP, the shoot moisture contents were least in control and roots moisture contents were least in urea. The chlorophyll contents differed insignificantly in various treatments with a tendency of least amount in organic matter treatment (Table 2). The number of fruits and seeds were maximum in DAP treatment (Table 2). The application of fertilizers appeared to have no profound affect on the overall growth and yield of *L. usitatissimum.* However, Chaubey and Dwived (1995) and Shahidullah *et al* (1996) reported that flax and other plants had improved growth with the application of fertilizers.

Effect of different light conditions. The variation in light conditions severely affects the overall growth performance of plants as observed in this case. All the plants died in shady conditions while the number of leaves and branches, fresh and dry weight and moisture contents (%) of shoots and roots and number of fruits and seeds (Table 2) were comparatively better in plants growing to full sunlight condition (Table 1). However, chlorophyll a and b and total chlorophyll contents were high in plants grown in partial light (Table 2). It appeared that *Linum* showed best growth in full light. Queida and Desbeiz (1992) and Antuono (1994) also observed that various light condition affected the yield of *Linum* and this agrees with our findings. Burel *et al* (1994) stated that bright light conditions induced thickness and hardness of stem and leaves that increased the weight of *L. usitatissimum.*

Table 2
Effect of different ecological conditions on the chlorophyll contents of *L. usitatissimum*

Growing condition	Chlorophyll a (mg/g)	Chlorophyll b (mg/g)	Total chlorophyll (mg/g)	No. of fruits plant	No. of seed/plant
a. Effect of soil type					
Sand	0.56	0.79	0.34	420*	422*
Clay	0.61	0.86	1.47	410*	406*
Loam	0.56	0.79	1.35	530	529
b. Effect of fertilizer					
Control	0.56	0.80	1.36	219	317
Urea	0.52	0.80	1.48	182	195*
DAP	0.56	0.82	1.37	343	355
OM	0.49*	0.63	1.12*	100	263*
c. Effect of light condition					
Full light	0.56	0.80	1.36	350	352
Partial light	0.62	0.89	1.05*	300	294*
d. Effect of different levels of soil moisture					
Field capacity	0.56	0.80	1.36	410	417
Water stress	0.56	0.82	1.38	40	143*
Water logged	0.37	0.54	0.91	18*	54*

DAP and OM, respectively diammonium phosphate and organic matter. * Significant at P=0.05.

Effect of different levels of water. The plants showed better height, number of leaves and branches, fresh and dry weight of shoots and roots and number of fruits and seeds in control, followed respectively by plants growing in water stressed and water logged conditions (Table 1). The total chlorophyll, chlorophyll a and b were least in waterlogged condition (Table 2). The water stressed plants were relatively better that those growing in waterlogged condition. Both the water stress (Gust *et al* 1991; Dubey 1994) and waterlogged condition (Dubey 1994; Mahto and Haque 1994; Malik *et al* 1999) reduced the yield attributes of *L. usitatissimum* and our findings agree with them. The present study suggests the possibility of growing *L. usitatissimum* in dry marginal lands as a source of biomass, oil and cover for the soil.

References

Antuono L F 1994 Response of *Linum* to light condition. *Industrial Crops & Products* **3** 291-295.

Bissent N G 1994 Herbal drugs and phytopharmaceuticals, *A Hand Book for Practice on a Scientific Basis /ed. And tranl from the 2*. German ed. Medpharm Scientific Publishers CRC Press, Tokyo, Japan.

Burel C, Berthe T, Morvan C 1994 Isoelectric focusing analysis of peroxides in flax seedling hypocotyle grown in different light conditions. *Plant Physiol & Biochem* **32** 853-860.

Cambert F J, Bower M, Andrews A C, Billotti W D 1990 The effects of soil moisture and planting depth on emergence and seedling morphology of *Asterbla lapacea* (Limdl) Domin. *Aust J Agri Res* **41** 367-376.

Chaubey A K, Dwivedi K N 1995 Effect of N, P and S and their interactions on yield and nutrient uptake by linseed. *J Ind Soc Soil Sci* **43** 72-75.

Connor O 1994 Effect of different soil conditions (sand, peat, clay & loam) conditions on linseed. *Can J Plant Sci* **74** 111-116.

Dubey P 1994 Excessive irrigation on yield and yield attributes of *Linum. Indian J Agronomy* **38** 91-94.

Fedeniuk R W, Biliaderis C G 1998 Composition and physicochemical properties of linseed mucilage. *J Agric Food Chem* **42** 240-247.

Gaudchau M, Marquard R 1995 Cadmium contents of two flax cultivars in sandy soil. *Verband Deutschar Landwirtschaftlicher Untersuchungs* **36** 349-352.

Hussain F 1989 *Field and Laboratory Manual for Plant ecology,* University Grants Commission, Islamabad.

Jalis A, Khan A A 1982 Effect of different nitrogen doses *on Mentha arvensis. Project Report Pak Tour* **36** 53-59.

Khan A S 1969 Chief constituents of fibre flax and their distribution. *Curr Sci* **31** 69-74.

Khan A S 1970 Vernacular names of flax. *Curr Sci* **33** 92-95.

Khodyankova S F 1995 Effectiveness of fertilizer application in soil for fibre flax on light loamy soil. *Agrokhimiya* **16** 53-60.

Mahto J, Trivedi H, Haque M 1994 Growth behaviour and genetic diversity in linseed under water-logged conditions. *J Res Birsa Agric University* **6** 16-21.

Malik S A, Dasti A A, Saqib T 1999 Growth and yield performance of same members of family Fabaceae at different levels of soil moisture. *Acta Slencia* **9** 15-24.

Mubarak B, Hussain F, Naqvi H H 1983 Effect of soil type and light condition on the growth of *Datura innoxia and Datrua fastuosa* Linn. *J Sci & Tech* **7** 1-3.

Queida A F, Desbiez M O 1992 Influence of light quality on fibre flax. *Cand J Bot* **70** 1087-1092.

Rossini F, Antuono L F 1994 Experimental estimation of linseed crop parameters. *Industrial Crops & Products* **3** 261-271.

Sahi F H, Leithch M 1994 Flax seed products and uses. *J Agric Soc University of Wales* **74** 95-104.

Sales G, Friedt W 1997 Composition of pedigree salection and single seed descent for oil yield in linseed *Euphytica.* **83** 25-32.

Samui R C, Roy B, Patra A K 1995 Response of linseed varieties to nitrogen. *Indian J Agronomy* **40** 132-134.