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Original Article

Feasibility Cultivation of Camelina (*Camelina sativa*) as Medicinal-Oil Plant in Rainfed Conditions in Kermanshah-Iran's First Report

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Abstract

In Iran, more than 90% of raw materials including oils and oil seeds are provided through import. *Camelina sativa* L. as an oilseed crop, belongs to Brassicaceae family, has been shown in several experiments that need very little water and resistant to chilling injury than other plant oils, especially canola. This Experiment was conducted at research station of Campus of Agriculture and Natural Resources in growing season 2013-2014. Seeds of *C. sativa*, DH1025 line, were cultivated in two sowing dates (6 November and 16November), with a row spacing of 20 cm and 3 cm between plants in a 3-square-meter plots in three replicates at each date. The results of the analysis of variance showed that two different treatments were significant difference for all the traits measured apart from the number of seeds per pod, number of branches, number of pods per plant, number of pods per branch, number of seeds per pod and plant height. The highest yield and biomass was observed in first planting date (6 November) with 217.667 and 514.33 g/m^2, respectively. Feasibility cultivation of *C. sativa* as a new medicinal-oil plant in rainfed conditions in Kermanshah was the major purpose of this investigation.

Key words: *C. sativa*, Oil seed, Medicinal plant, Kermanshah

Introduction

Oils and oil seeds are the raw materials used in the oil industry. In Iran, most raw materials (more than 90% of raw material) to production of oil are supplied through imports [1]. Shortage of oilseeds and high volume oil imports in Iran and high limitation of water resources in the country for production of oilseeds emphasize the need to identify the species and varieties adapted to drought conditions, it becomes apparent [2].
When the goal is to introduce a new species as a suggested crop and its potential role is analyzed, it must meet unique and desire characteristics that set it apart from the existent cultivated species [3].

Camelina sativa L. as an oilseed crop is a member of the family of Brassicacea has been shown in several reports which require much less water and more resistance to chilling injury than other plant oils, such as canola. This plant also has very high resistance against pests such as cockroaches and pollen-eating that is common in oilseeds. Potential for high performance of *C. sativa* have been reported in Montana State and are taking it as a good option to put in rotation with cereals [4]. *C. sativa* is native to Europe and South Asia, and sometimes grows as a weed in fields. But the history of its cultivation goes back 4000 years [5].
C. sativa can be sown directly into the residue at the surface by broadcast-sown, or it can be

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cultivated on marginal lands. Sowing does not require special expensive equipment [6].

C. sativa has several properties that are in various fields, some of which are mentioned below: [4]

- Nutrition: *C. sativa* oil is used to increase the nutritional value of foods such as bread and butter.

Health: benefits of high Omega- 3 have caused the medical uses including the prevention and treatment of obesity and postmenopausal breast cancer in women.

- Fuel industry: commercial companies worldwide produce biofuels from of *C. sativa* as well as soybean oil.

- Manufacture of resins and waxes: *C. sativa* oil could be a substitute for other waxes (which is rare and expensive) that has many applications in various industries including cosmetics industry.

- Seed and Soil Conservation: *C. sativa* seed is covered by gummy layer that can be used as a cover for other seeds to germinate slowly and more safely in the soil. The resin can also be used to prevent soil erosion.

- Manufacture of poultry and fish feed: high quality omega-3 to five percent, 40 percent protein, 10 to 12 percent fat and 1600 calories per pound made *C. sativa* meals a proper diet for livestock, poultry and fish.

Considering the broad range of *C. sativa* uses in feed and food production, cosmetics, pharmaceutical, biofuel and bio-oil industry, it is important to establish its genetic potentials and cultivation peculiarities for maximum yield [7]. Oil content in *C. sativa* seeds has been reported to range from 25% to 48%. The adaptability of crops to the environment causes considerable variation in the oil content of the seeds from different locations [8-9].

So far, has not been published any reports on research, study and cultivation of medicinal- oil *C. sativa* in Iran and this is the first report on the country. This experiment aims to investigate the possibility of cultivation of *C. sativa* in Kermanshah province in two date.

Material and Methods

The experiment was conducted in research farm of College of Agriculture and Natural Resources, Razi University of Kermanshah, Iran in the growing season 2013-2014 in a randomized complete block design with 3 replications. Seeds of DKDH1025 line (doubled haploid population derived from anther first generation cross) were cultivated in two sowing dates (6 November and 16 November), with a row spacing of 20 cm and 3 cm between plants in a 3 m^2 plots in three replications per date. Weed control in any way, either manually or chemically was not performed and cultivation conditions were without irrigation. Traits studied in this experiment are shown in Table 1.

Table 1 Evaluated traits in oil and medicinal plant *Camelina sativa* L. cultivation

Row	Traits	abbreviation
1	Yield	Y.
2	Number of Pod Per Plant	N.P.P.P
3	Biological Yield	BY
4	Plant Height	P.H
5	Number of Pod in Branch	N.P.B
6	Number of Seed in Pod	N.S.P
7	Number of Branch	N.B
8	Root Length	R.L
9	Pod Straw Weight	P.S.W
10	Plant Density	P.D
11	Days to Flowering	D.F
12	Days to Maturity	D.M

Results and Discussion

Results of variance analysis (Table 2) showed that two different sowing dates were significant for all the measured traits except for the number of seeds per pod, number of branches, number of pods per plant, number of pods per branch, number of seeds per pod and plant height. The highest yield and biomass was observed in first planting date (6 November) with 217.667 and 514.33 g/m^2, respectively. Performance of about 197 g/m^2 in America and in Montana dryland conditions in 2008 were reported by McVay.

Traits such as plant height, number of seeds per pod, number of branches and pods per plant showed no significant differences between planting dates and plant density per cubic meter seems that (as in the first planting date was significant more the second planting date) is the most significant factor in high performance of first planting date.

It seems that the higher temperature in the first planting date caused more appropriate germination rate of this treatment. Therefore, sowing in early November could be recommended for Kermanshah and similar climates. However, to determine the precise planting date in the region, several years of experiments are needed.

Table 2 Analysis of variance of *Camelina sativa* L. traits under two sowing dates in Kermanshah rainfed condition

		MS					
SOV	df	Y	N.P.P.P	BY	P.H	N.P.B	N.S.P
Repeat	2	11.05 ^{ns}	11265.5^{ns}	116.05^{ns}	81.05^{ns}	60.26^{ns}	0.99^{ns}
Treat	1	56560.05**	28560.05^{ns}	266693.38**	722^{ns}	141.68^{ns}	0.108^{ns}
Observed	2	5.05	7177.16	50.38	48.16	20.97	3.40
Error	12	22.33	2697.88	60.83	27.27	17.51	1.02
Data means of the 1st sowing date	-	217.66	250	514.33	88.22	21.80	11.07
Data means of the 2nd sowing date	-	105.55	170.33	270.88	75.55	16.18	10.92
C.V.	-	2.92	28.93	1.98	6.37	22.03	9.19

ns: No significant ; * P< 0.05 ; ** P<0.01

Table 2 Continue...

		MS					
SOV	df	N.B	R.L	P.S.W	P.D	D.F	D.M
Repeat	2	12.05*	0.722^{ns}	6.50^{ns}	1568.05^{ns}	0.388^{ns}	0.388*
Treat	1	0.50^{ns}	56.88*	37904.22**	35644.50**	40.50*	144.50**
Observed	2	0.50	1.05	13.38	210.16	1.16	0.16
Error	12	3.94	3.50	29	30	1.33	0.66
Data means of the 1st sowing date	-	7.22	23.22	175.22	292.55	157.22	191.55
Data means of the 2nd sowing date	-	6.88	19.66	83.44	203.55	154.22	185.88
C.V.	-	28.14	8.72	4.16	2.20	0.74	0.43

ns: No significant ; * P< 0.05 ; ** P<0.01

Despite the extreme long cold in growing season, plant growth does not adversely affected after the germination and the plant grew well in the other stages.

Commonly cultivated oil plants such as soybean and sunflower require abundant water supply and irrigation. However, our results suggest that cultivation of this plant in dry climates in many climates of the country can leads to favorable outcomes, such as reducing dependence on imported oil seeds, water conservation and efficient use of dryland farms. All stages of *C. sativa* growth until grain filling stage were completed when there was highest spring precipitation in the region (late-April and early-May in Kermanshah condition) and unlike other oil-producing plants, it does not need spring irrigation. Self controlling of weeds due to its allelopathic properties [10] reduces the cost of chemical and mechanical controls. In addition, the desired plant height (about 80 to 100 cm), makes possible mechanized harvesting which is a major advantage compared to some other rainfed crops. It is clear that further research is required to be carried out before proposing *C. sativa* as a field crop.

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