Chapter-I

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Oil seeds occupy an important position in national economy of our country. Various types of oil seeds are being utilized in our day-to-day life from time immemorial. Besides being used as edible oil, multifarious industrial use of vegetable oils as the raw material of lubricants, soap, paints, varnishes etc and use of oil cake as cattle feed, concentrated organic manure, pesticide etc. not only has made the oil seed one of the indispensable part of the every day life of the Indian populace, it has also provided direct and indirect employment to a large number of people and thus have proved themselves as one of the vital part of the agriculture dominated economy of India.

The production scenario of oil seeds in India has passed through dramatic upheavals. The dramatic transformation of Indian oil seed economy from a "net importer" status in the eighties to a "self sufficient" and more so a "net exporter" status during the early nineties has been popularly termed as the "yellow revolution". From a mere 11 million tonnes during 1986-1987, the country attained an all time record oil seed production of 25 million tonnes during 1996-97, just in the span of a decade.

India has the distinction of being next only to U.S.A. in terms of are under oil seeds and stands fourth in terms of production when compared to other oil seed producing countries, and this quantum leap in production can be said to be the result of
the technology mission of oil seeds (T.M.O.) and a series of synergistic and farmer oriented policies it has launched, backed up by better availability of crop production technologies and other inputs and services as well as support price policy (Hegde and Kiresur, 1999). During the last two decades over 240 improved varieties/hybrids have been developed in annual oil seeds, which have shown 9 to 38 percent yield superiority over their locally cultivated counterparts. However there is scope to evolve varieties or hybrids which can give 50 percent or more yield in on-farm condition (Hegde and Kiresur 1999).

India’s population, growing at such annual compound growth rat which expected to be 15.46 million by the year 2020. The Indian council of Medical Research (I.C.M.R.) has recommended an intake of 20 gm oil adult\(^{-1}\) day\(^{-1}\) (7.3 kg a year) and at this rate the total oil requirement by 2020 AD will be 10,495 million tonnes which could be extracted from 34,636 million tonnes of edible oil seeds on the assumption of 33 percent recovery across all the oil seeds. The edible oil consumption and annual demand for vegetable oils may grow at the rate of 5.5 to 6 percent in the next 10 year if our G.D.P. growth rate is maintained at 4 percent per annum.

Among the oil seed crops, linseed occupies an important position in India. Linseed (Linum usitatissimum), also known as flax, is an important source of edible as well as industrial oil and is also used, as a fibre crop. The fibre of the plant is the raw material for producing “Linen”. The oil rich seed in crushed with mustard and the paste is used “chutney” in daily
diet in some parts of India. The average oil content in the seeds varies form 33-47 percent among the various varieties of linseed. The oil is edible and also due to its quick drying property is used for the preparation of paints, varnishes, printing ink, oilcloth, soap, patent leather, and waterproof fabrics. The oil cake left after the oil is pressed out is almost valuable feeding cake, perhaps the most favourite cattle feed. It is good in taste and contains 36 percent protein, 85 percent of which is digestible. It is fed to both milch and fattening animals. It is also used as organic manure. It contains about 5 percent nitrogen 1.4 percent phosphorus and 1.8 percent potash. Straw from seed varieties are used in the manufacturer of upholstery two, insulating material, rugs, twine, and paper. Linseed is extensively grown in the countries of the Temperate Zone as well as in those of the tropical zone.

The major linseed-growing countries are Argentina, the USSR, India, the USA, Canada, Pakistan and Australia, India accounts for about 1.9 million hectares, with a seed production of 4.98 lakhs of tonnes and occupies the third rank among the linseed-producing countries. Australia and Canada have the highest productivity of about 7 quintals per hectare, whereas India averages 255 kg per ha. This yield is the lowest in the world.

In India, Madhya Pradesh leads in yield and acreage, followed by Uttar Pradesh and Maharashtra, Bihar Rajasthan, Karnataka and West Bengal also grow linseed in large areas. Madhya and Uttar Pradesh together contribute to the national linseed production to the extent of about 70 percent. In Uttar Pradesh, Bundelkhand is one of the major oil seed and pulse
growing region because of the black cotton soil which is more prevalent in the southern part of it. Bundelkhand region has several types of soil. Among them the black cotton soil locally known as "Kawar" or "Mato"; "Rakar soil", "Mar" and "Paruwa" soil are the prevalent on and patches these soils are scattered over the whole region.

Linseed crop shares for about 15 percent area under Rabi crop in this region. This dominance may be attributed to the fact that linseed can be grown well in low moisture condition and so the farmers of this water starved region, have a preference for this crop. However, the production as well as productivity is quite low because of primitive sowing method like broadcasting, non-availability of improved variety, lack of awareness about better agro-techniques and perpetual scarcity of basic agro-inputs like fertility, irrigation etc. the poor quality of the soils play its part in lowering the quality of the crop. Farmers use this crop as a part of mixed or inter cropping systems as a policy for crop insurance.

India produced 27.9 million tonnes of oilseeds during 2005-06 which is nearly 2.6 times more than that produced during 1985-86. As nearly 75 percent of oilseeds are is rainfed, there are wide fluctuations in oilseeds production in response to aberrations in weather conditions related mainly to amount and distribution of rainfall (Hegde, 2007)

In India during 2000-2001 The area, production and yield were 412 thousand ha 260 thousand tonnes and 631 kg ha-1, respectively. In M.P. 2005-06. The corresponding figures were 136
thousand ha, 56 thousand tonnes and 412 kg ha\(^{-1}\) (commission, Land Records, M.P., Ministry of Agriculture G.O.I.).

Rain water may not be sufficient to make the nutrients available and the beneficial effects of fertilizer application might be negligible or even detrimental. Therefore, soil moisture is one of the most important factor influencing seed and oil content of the crop. Irrigated crop produces significantly higher yields over the rainfed crop (Shekhawat et al., 1972; Singh et al. 1974). Excess soil moisture leads to vegetative growth and adversely affects the seed yield, while stress condition reduces seed setting/filling and subsequently seed and oil yields. The total water use by the crop is associated with the availability of moisture in the root zone (Singh and Singh, 1978).

During past the water requirement of linseed has by and large been worked out based on conventional approaches (viz. number stages of irrigations) which have less validity due to atmospheric and edaphic conditions. The scheduling of irrigation based on climatological approach i.e. IW/CPE ratio which is now considered as most scientific need to be adopted.

The crop growth during early growth stages has been promoted by fertilizer application, but due to lack of soil moisture reserve during some critical stages or later growth stages has resulted in poor yield of crops or no yield at all. Development of science of plant nutrition has already established that correct fertilization of crop plants for realization of satisfactory yield is a very complex problem. Well conducted field experiment may give a clear cut idea of vital role played by various factors affecting
growth. The growth and the final yield of crop plants besides many other factors, is greatly influenced by proper combination of soil moisture and nitrogen. Among the primary nutrients nitrogen is important in plant nutrition under Indian conditions. Although a few investigations have been accomplished on nutrition and moisture aspect of linseed crop, still more work has to be done on regional basis specially under irrigated conditions.

Nitrogen is known as one of the primary or major plant nutrients. The grain of crop produced under conditions of low nitrogen supply has poor protein content. Combined effect of irrigation and nitrogen bear a great impact on growth and yield of linseed. Mixed nutrients applied together maximize the production and quality of oilseed crops rather than the application of individual (Pasricha et al. 1988)

The crop/variety responds differently under various sets of agro-climatic conditions. Linseed is grown mainly either in unirrigated areas or under utera/mixed cultivation, where the high yielding varieties are not able to express their potential. Therefore, the responses of major factors of production is to be worked out under different ecological conditions for the over all increase in the yield and quality of the crop.

Since, the information on the above aspects is fragmentary and insufficient, therefore, taking the above facts into consideration the present investigation was carried out at Research Farm of Brahmamand Mahavidyalaya, Rath (Hamirpur) U.P., on linseed crop with the following objectives.
1. To find out optimum (IW/CPE ratio) schedule of irrigation for the linseed crop.

2. To find out optimum level of nitrogen for linseed.

3. To find out the suitable/economic combination of irrigation schedule (IW/CPE ratio) and nitrogen level for maximum production of linseed.

4. To work out the consumptive use, water use efficiency and moisture depletion pattern.