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Impact of Land Configuration and Nutrients Levels on Growth, Yield Attributes and Yield of Oilseed Crops: A Review

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ABSTRACT

Crops are sown using a variety of land configuration techniques, which have major benefits for the correct growth of oilseed crops as well as for the effective use of water and the management of soil erosion. Different land configurations like flat bed, line sowing, and broad bed furrow play an important part in reducing problems with plants and soil like spacing, water need, and nutrient retention. Land layout factors like slope and elevation may also have an impact. Nutrient concentrations like nitrogen, phosphorus, and potassium are necessary for a plant to grow and develop. While insufficient nutrient levels might limit development and lower production, sufficient nutrient levels can increase crop yield and quality. Other than macro nutrients sulphur element is also one of the major nutrients for the better production of oilseed crops. The majority of crops typically flourish on marginal, poor soils with unbalanced nutrient applications. Nitrogen is one of many nutrients that is essential for all crops. One of the most crucial elements needed to increase agricultural yield and profitability in semi-arid climates is nitrogen management.

***Key words**: Oilseeds, Land configuration, Nutrient management, Nitrogen, Growth, Yield, Economics*

Introduction

Oilseed crops are second most important commodity of agriculture after cereals. Even though India is the fourth largest oil producing country globally (after USA, China and Brazil) with annual production of 33.22 million tonnes and productivity of 1224 kg ha^{-1}, we are the largest importer of edible oil (15 per cent globally) with import value ranges between 66,000-1,41,000 crore (Anon., 022). In the year of 2021 – 22, India's total domestic oilseed production was 126.4 lakh tones and oil consumption were 267.1 lakh tones, in ordered to meet the domestic demand Government of India imported 140.7 lakh tons of oil from foreign countries. The productivity of oil seed in India is low and main reasons are, 70 per cent of oilseeds are cultivated under rainfed ecosystem, erratic rainfall pattern, incidence of pest and disease and global challenges such as environmental degradation and climate change. Yield gap between demand and consumption can bridge by either improving productivity of the existing oilseeds growing area or bringing more area under cultivation. Bringing of more area under cultivation is not possible due to reduction in per capita land availability. The productivity of the existing land can be improved by adopting management practices such as choice of suitable land configuration and nutrient management which in turn increase the use of efficiency of applied inputs.

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Land configuration includes land modification technique such as flat bed, ridges and furrows and broad bed furrow, which alter the shape of seedbed and surface of land. Land configuration helps to improve the water use efficiency by facilitating the infiltration of water received through rainfall as well as irrigation. It minimizes the erosion/ runoff of soil and also allows the drainage of excess water from root zone (Singh *et al*., 2017; Zhang *et al*., 2007; Li *et al*., 2010). Leeching of salt, reduced evaporation, better aeration, increased nutrient availability and enhanced root zone depth are the other benefits of land configuration (Parihar *et al*., 2012; Ramesh *et al*., 2020). But, the adoption and success of land configuration is mainly depended on the type of soil and rainfall received during the cropping period (Kamble *et al*., 2016; Sathiya *et al*., 2020).

Every crop needs nutrients to fulfil their needs and nutrient management is the most important for the improving the growth and productivity of crop. Nutrients are absorbed, translocated and assimilated by the plants and the process of absorption, translocation and assimilation is known as mineral nutrition. Not each of the essential elements is provided by soil like carbon, hydrogen and oxygen because they are not minerals and they are not absorbed by plant from soil. Oilseed crops shows retardance growth mainly for nitrogen and sulphur deficiency. Decrease in production, productivity as well as poor quality was mainly due to lack of proper nutrient management techniques. The Indian soils are mostly deficient of nitrogen and zinc, hence nitrogen is governing above earth growth the deficiency of nitrogen shows retarded growth in yield and quality of oil as well as protein content (Guo *et al*., 2016). Every nutrient having their key role to play in growth and production of plant some of them needs in larger quantity like macro nutrients (N, P, K, Ca, Mg, S) and some of them needs in lower quantity like micro nutrients (Fe, Mn, Zn, Cu, B, Mo, Cl, Ni, Na, Co, Si). Nitrogen is required by plant during its initial phase and some critical times for its vegetative growth so that the proper management of nitrogen is required for improving crop yield (Amanullah, 2016). Like it is mentioned above nitrogen helps in above earth plant growth like that phosphorus governing the root growth. Without phosphorus plant cannot complete their lifecycle that why phosphorus is called as key to life.

Nitrogen helps in synthesis of amino acids and play essential role in constituent of protein, nucleic acid, chlorophyll, vitamins etc. while phosphorus constitute of phytin, root length, root branching, ATP and required for reproductive function of the plant (Om *et al*., 2013). Fertilizer affects oilseed crops very quickly. For the creation of DNA and RNA, photosynthesis, and chlorophyll, nitrogen is necessary (Hirel *et al*., 2007). From seed until harvest, plants require different amounts of the macronutrient nitrogen. However, the requirement for nitrogen fertiliser may be decreased if there is some nitrogen present in the soil already in an obtainable form. Proper management led to increased crop production and decreased fertiliser costs (Hossain and Islam, 1986). Nitrogen and sulphur are closely related to each other both of them required for protein synthesis and they required in constant ratio within the plant tissue (Kumar *et al*., 2017).

Effect of land configuration on growth of oilseeds

Land configuration is one of the major aspects to maintain or increase growth and yield of oilseed crops. Studies have shown that oilseed crops grown on sloping land have lower yields compared to those grown on flat land. This is due to water runoff, erosion, and reduced soil fertility on sloping land. Sathiya *et al*., 2020 conducted an experiment and found that i.e., groundnut cultivated in broad beds and furrows had taller plant height and a greater number of branches as compared to flat beds. Gunjal *et al.,* (2022) examined periodically how the plant was growing in terms of its height, spread, number of branches, leaf area, and dry matter per plant. Ridges and furrow (3 ft) produced the highest plant height, plant spread, number of branches, leaf area, and dry matter per plant at harvest compared to the other land configurations, but it was comparable to broad bed furrow in terms of plant height and branches count throughout the growth period. The outcome was comparable to that reported by Basendiya *et al*., 2017; Vyas *et al*., 2014 and Dhale, 2018. In an agronomic investigation conducted by Saravanan, 2022 found that significantly higher plant growth parameter was recorded with ridge and furrow followed by raised and flat bed in groundnut crop.

Effect of land configuration on yield of oilseeds

Land configuration directly or indirectly effect reproductive growth of oilseed crops. Singh *et al*., 2017 conducted a field experiment to study the effect of land configuration methods and sulphur levels on

growth, yield and economics of Indian mustard (*Brassica juncea* L.) under irrigated condition. They found out significantly higher yield parameter such as number of siliquae per plant as well as seed yield with furrow sowing, while minimum was recorded with flatbed broadcasting followed by flatbed kind of land configuration. Similarly, an experiment was conducted to determine the impact of various land designs and plant densities on yield and economics of Indian mustard by Divya *et al*., 2021. They reported that significantly maximum yield parameter such as number of siliquae per plant, number of seeds per silique and seed yield recorded in broad bed furrow followed by ridge and furrow and minimum yield parameters were recorded in flat bed. Significantly higher plant growth parameters such as number of pods, weight of pods and weight of seeds in soyabean cultivation were recorded with broad bed furrow and minimum were recorded with ridge and furrow followed by flatbed type of land configuration. Same pattern were followed by safflower crop as scientist work on both the crop simultaneously such as weight of capitula, number of seeds was recorded significantly higher in broad bed furrow as reported by Bhadre *et al*., 2019. Significantly higher oil content (%), seed yield, and oil yield were recorded in the land configuration of ridges and furrows and minimum were recorded in flatbed method in sunflower cultivation (Uttarwar and Chorey, 2022). Another agronomic investigation was conducted by Navrange *et al*., 2022 to study the effect of land configuration and weed management practices on yield and economics of sesame and they found that significantly seed yield, stover yield and biological yield were recorded with broad bed and furrow system and minimum yield attributes were recorded with flat bed. Mechanizations and land configuration effects on soybean productivity, growth, yield, and economics (*Glycine max* L.) are the subject of an agronomic investigation, was conducted by Thoke *et al*., 2022. They found that significantly higher yield parameters were recorded in broad bed furrow and minimum yield attributes were recorded by flat bed. Saravanan *et al*., 2022 reported that significantly higher yield parameters were recorded with ridge and furrow method of land configuration. Pod weight and number of pods per plant were higher in ridge and furrow followed by raised bed and flatbed method. Chavan *et al.*, 2018 reported that among different land configuration in (flatbed sowing at 60 x 30cm, flat bed with paired row planting at 45 x 40 cm., ridges and furrow at 60 x 30 cm. and broad bed and furrow), significantly higher yield parameters such as filled seeds, unfilled seeds and seed yield were reported with ridge and furrow method of land configuration followed by broad bed and furrow, flat bed with paired row planting and flatbed.

Effect of land configuration on economics of oilseeds

Different land configuration provides different support to crop hence the change of sowing method may increase or decrease economic value of crop. Like in an agronomic investigation conducted by Sathiya *et al*., 2020 to study the effect of land configuration and mulching on growth, yield and economics of groundnut and they found that significant higher economic parameter such as benefits cost ratio (2.25) were recorded in raised bed and furrow method over the other treatments. Bhadre *et al*., 2019 conducted an experiment for two years on two different oilseed crops and they reported significant higher plant economic parameters such as higher net monetary return and benefits cost ratio (2.34) in broad bed furrow followed by ridge and furrow and flatbed method. In case of sunflower crop ridge and furrow method recorded significant higher plant economic rates such as gross monetary return (Rs 31498 ha^{-1}), net monetary return (Rs 14394 ha^{-1}) and benefits cost ratio (1.84) and there parameters were lowest under flat method (Uttarwar and Chorey, 2022). Singh *et al*., 2017 observed that significant higher economic parameters such as gross return, net return and benefits cost ratio in furrow method of land configuration in Indian mustard crop followed by ridge method, flat method and lowest parameters were recorded in case of broadcasting method of land configuration. To assess the effect of different land configurations and plant densities on yield and economics of Indian mustard, an experiment was carried out by Divya *et al*., 2021 and under this investigation they scientists they recorded significant higher economic parameters like gross returns, net returns and benefits cost ratio in broad bed furrow type of land configuration followed by ridge and furrow method and least parameters were recorded in flat method of land configuration.

Effect of nutrients on growth of oilseeds

Nutrients contributes to great extent in growth parameters of oilseed crops. Increase or decrease doses

of nutrients affect crop growth, yield and oilseeds quality. A field experiment was conducted by Kumar *et al.*, 2017 to study the effect of nitrogen and sulphur nutrition on growth and yield of Indian mustard *(Brassica juncea* L.). They reported that significant higher growth parameters were recorded with increasing nitrogen level up to 120 kg/ha such as increase in cell size which morphologically increases the plant height, leaf area and branches per plant. In case of sulphur application, maximum growth was recorded at 40 kg/ha. Nitrogen acts as key element in oilseed crops and provides green colour which helps in maximum photosynthesis and resulting in higher dry matter. Similar results were observed in findings of Kumar. Mishra and Debbarma, 2022 conducted an investigation on toria to study the effect of nitrogen and weed management on growth and yield. Under this investigation the significant higher growth parameters were recorded where nitrogen doses were at 50 kg/ha and followed by 40 kg/ha. Raghuvanshi *et al*., 2018 recorded significant higher growth parameters such as plant hight, leaf area index, number of branches and dry matter with 120 kg/ha of nitrogen level while minimum growth parameters were recorded in control treatment. These results are in conformity with findings of Ram *et al*., 2013 who found significant higher growth parameters at 120kg/ha level of nitrogen while studying the effect of nutrient management on growth and yield attributes of Indian mustard. In case of phosphorus, significant increase of growth attributes such as plant height, dry matter and number of branches were increasing up to 60 kg/ha level of phosphorus. Singh *et al*., 2012 conducted an investigation on two nutrient fertilizers i.e., nitrogen and sulphur and the results of investigation revealed that significant higher growth parameters were recorded at 80 kg/ha level of nitrogen and 60 kg/ha level of sulphur. Significant higher plant growth parameter such as plant height, leaf area index, number of branches and dry matter accumulation were recorded at 40 kg S/ha level than other treatment in all growth stages of Indian mustard (Singh *et al*., 2017). Verma and Dowson., (2018) reported that significant higher growth parameters such as plant height (101.2 cm), plant dry weight (19.6 g) and maximum number of branches per plant (9.9) were recorded in the treatment (T5) sulphur 30 kg/ha and boron 2 kg/ha with line sowing of yellow sarson crop and lower parameters were recorded in other treatments. Chavan *et al*., 2018 conducted an experiment to study the effect of land configuration and fertilizer levels on growth, yield and quality of sunflower. They reported that application of 100 per cent RDF recorded significant higher growth parameters followed by 125 per cent RDF and 75 per cent RDF.

Effect of nutrients on yield parameter of oilseed crops

An agronomic investigation was carried out by Dongarkar *et al*., 2005 to study the effect of nitrogen and sulphur levels on growth and yield of mustard. Under this investigation, the results revealed that 75 kg N/ha and 40 kg S/ha showed significant higher yield attributes such as number of siliquae per plant, seed yield and stover yield and minimum yield attributes were recorded in 0 kg N/ha and 0 kg S/ha. Bhadre *et al*., 2019 conducted an agronomic investigation to study the performance of soybean-safflower cropping sequence under different land configuration and nutrient management. They concluded that significant higher yield attributes like number of pods, weight of pods and weight of seeds in case of soybean and number of capitula per plant and weight of capitula in safflower were recorded at 5 kg S/ha of sulphur dose followed by 2.5 kg S/ha and 0 kg S/ha. To study the influence of different land configurations and fertilizer levels on quality, yield and economics of sunflower, a field experiment was conducted by Uttarwar and Chorey 2022. The result showed significant higher seed yield per plant and number of seed per plant with the application of 125 per cent RDF which was significant superior over 75 per cent RDF and 100 per cent RDF. Similarly, a field experiment was conducted by Chavan *et al*., 2018 to study the effect of land configuration and fertilizer levels on growth, yield and quality of sunflower. They observed significant higher seed yield per plant and number of seed per plant with the application of 100 per cent RDF which was significant superior over 125 per cent RDF and 75 per cent RDF. Singh *et al*., 2012 reported that significant higher yield parameters such as length of siliqua, number of siliquae, seed yield and stover yield were recorded maximum at 80 kg N/ha and 60 kg S/ha application and minimum yield attributes were recorded under control plot treatment in mustard crop. Another agronomic investigation was conducted by Raghuvanshi *et al*., 2018 to study the influence of nitrogen on yield of mustard crop and the investigation revealed that significant in-

crease in yield from 0- 160 kg N/ha and recorded maximum seed yield and stover yield at 160 kg N/ha and minimum yield was recorded in control treatment. To study the effect of nitrogen (N) and sulphur (S) on yield and yield components of rapeseed, a field investigation was conducted by Islam *et al*., 2018 and during this investigation they reported significant higher yield attributes related to seed yield, stover yield, biological yield and harvest index at 120 kg N/ha and 45 kg S/ha individually and while combination of both nitrogen and sulphur (120kg N/ha X 45 kg S/ha) recorded highest yield as compared to any other treatment and minimum yield attributes were recorded in control treatment. Om *et al*., 2013 conducted a field experiment to understand the influence of nitrogen and phosphorus applied fertilizer on growth and yield of mustard crop. They reported significant higher seed yield, stover yield and number of siliquae per plant in directly applied nutrients in mustard crop at rate of 60 kg N/ha + 60 kg P_2O_5 over other fertility levels. Mishra and Debbrma, 2022 reported significantly higher plant height (112.2 cm), maximum dry weight (16.4 g/plant), maximum number of siliqua/plant (197), test weight (3.8g), number of seeds/siliqua (20.4), seed yield (1.48 t/ha) and stover yield (3.61 t/ha) at 50 kg N/ha + hand weeding as compared to other treatments.

Effect of nutrients on economic parameter of oilseed crops

Bhadre *et al*., (2019) carried an investigation to study the performance of soybean-safflower cropping sequence under different land configuration and nutrient management and they recorded significant higher economic values like net monetary returns (Rs 66357ha^{-1}) and B:C ratio (2.9) at 2.5 kg S/ha and minimum were recorded at 0 kg S/ha. A field experiment was conducted to study the effect of nitrogen and sulphur nutrition on growth and yield of Indian mustard (*Brassica juncea* L.) by Kumar *et al*., 2017 and under this investigation they recorded significantly higher economic attribute such as gross returns, net returns and benefits: cost ratio at 120 kg N/ha and 40 kg S/ha and minimum profit were recorded under control treatment of nitrogen and sulphur. Another field experiment was conducted by Singh *et al*., 2017 to study the effect of land configuration methods and sulphur levels on growth, yield and economics of Indian mustard (*Brassica juncea* L.) under irrigated condition and they recorded significant higher gross returns, net returns and benefits: cost ratio at 40 kg S/ha sulphur level and minimum profit were recorded from 0 kg S/ha to 30kg S/ha. Significant higher economic attributes like gross returns, net returns and benefits: cost ratio was recorded at 100 per cent RDF by Chavan *et al*., (2018) while studying the effect of land configuration and fertilizer levels on growth, yield and quality of sunflower followed by 125 per cent RDF then 75 per cent RDF.

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