REVIEW OF LITERATURE

Pea (*Pisum sativum* L.) belongs to the family *leguminoseae*. It is a cool season, self-pollinated and hardy tendril climbing plant. It is grown primarily for edible pods. In addition to its nutritional value, it is a rich source of protein, good source of vitamins A, B and C and also contains a high proportion of minerals. So, that pea is considered as one of the most important source in human food nutrition for such nutrients. The major factors, which contribute to the crop yield, include; use of improved cultivars, balanced nutrition and cultural practices. If the crop is managed properly, green pods are produced continuously for several months.

Singh and Joshi (1970) reported that maximum cultivation of pea is in U.P. which occupies for about to present area at this crop followed by Bihar and M.P.

Ali and Kumar, (2005) studies that the largest estimates for 2003-04 indicates that the production of pulses in the country is 15-25 million from an area of 24.45 million hectares and productivity is 63 kg per hectare.

Vashney *et al.* (2005) reported that peas are grown on 7.9 lac hectare area with the production and productivity in the country of 8.3 lac tones and 1020 kg/ha, respectively. In Uttar Pradesh pea is grown on 4.24 lac hectare which is 53.7 per cent of total national area.

The information documented in literature on the relevant aspect of the crop in relation to phosphorus fertilization in pea has been compiled and presented as under in the following chapter:

2.1. Response of Phosphorus

2.1.1. Effect of phosphorus on growth characters

Vellayuttam and Shanmugam (1972) reported phosphorus is important in root development and nodulation and it give a rapid and vigorous start to plants by stimulating early and abundant root development.

Berg and Lynd (1985), French (1990), Bolland *et al.* (2001) reported that the yield advantage produced by applied P could be attributed to an increase in number of branches and
number of reproductive nodes.

Srivastava and Verma (1985) found that increasing P$_2$O$_5$ rate up to 60 kg ha$^{-1}$ markedly increased the growth of peas. Significant increase in growth has also been observed with phosphorus application in pea (Kanaujia et al., 1997; Parsad et al., 1989) and in cowpea (Baboo and Mishra, 2001).

Maiti et al. (1988), Bengtsson (1989) and Dravid (1991) reported that the application of increased levels phosphorus have positive relationship between growth and yield parameters. However, Thakuria and Ioikham (1990) reported that phosphatic fertilization in pea is of great importance as it affects nodulation, growth and yield.

Sarkar and Banik (1991) reported that the nitrogen and phosphorus fertilization could be as a result of improvement in growth and yield contributing characters. However, Gubbels (1992), Padmalatha and Rao (1993), Sarvaiya et al. (1993), Yadav and Chauhan (1997) and Verma et al. (1998) observed that plant height, number of branches, shoot dry weight, number of pod, seed yield and biomass yield were increased by application of phosphorus up to 60 kg P$_2$O$_5$ ha$^{-1}$ and then decreased at 90 kg P$_2$O$_5$ ha$^{-1}$.

Shukla et al. (1993) reported that increasing phosphorus application has no effect on seed germination when pea cultivars were applied P$_2$O$_5$ @ 45, 60 or 75 kg/ha. Similar results have been reported by Padrit et al. (1996). However, Kanaujia et al. (1997) reported from Himachal Pradesh that growth and nodulation increased significantly up to 60 kg P$_2$O$_5$.

Patel et al. (1998) reported that application of 50% nitrogen, increased plant height, number of branches, leaves per plant, number of pods per plant, grain per pod and yield significantly compared with recommended level of nutrients (20kg N + 80 kg Phosphorus + 20 kg K) applied through chemical fertilizers.

Vorob (2000) recorded positive effect of joint application of phosphorus and potassium at alk properties on growth and yield of pea. Singh and Singh (2002) indicated that the phosphorus application gave pronounced effect on growth parameters and yield components. However, Yemane and Skjepvag (2003) found that phosphorus biomass, leaf area index, branches/plants, pods/plant and yield responded positively while seeds/pod and seed weight were not significantly
affected by Phosphorus.

Aga et al. (2004) observed that phosphorus levels also significantly influenced crop growth and yield favorably. Application of 60 kg P2O5/ha recorded the maximum seed and straw yield of pea in both gears.

2.1.2. Effect of phosphorus on yield and yield attribute characters

Khan et al. (1952) observed that increase in the yield of legumes, in both seasons, due to phosphorus fertilizers. However, Eira et al. (1974) reported that highest yield of pea with 79 kg P2O5/ha, but the most economical rate was 55 kg /ha in alluvial soil.

Patel and Parmar (1986) reported that increasing P application from 0 to 90 kg P2O5/ha increased average grain yield from 0.77 to 1.05 t/ha in pea but had no effect of plant height, number of branches/plant of pod length.

Upadhyay et al. (1991), experimented with P2O5 at the rate of 0-60 kg/ha with and without rhizobium inoculation. Seed yield was higher with inoculation and increased upto 40 kg P2O5. However, Sharma et al. (1992) reported that phosphorus application gave progressive increase in the dry weight of shoots, pods per plant, seeds per pod and seed yield in all genotypes. Patel and Sutaria (1993) reported that yield and P uptake in all crop were increased by application of P, although the optimum rate varied between crops.

The highest rate of phosphorus produced maximum number of pods per plant of pea and similar in French bean (Ahlawat, 1996; Kanauija et al., 1999; Parmar et al., 1999; Singh, 2000; Srivastava and Ahlawat, 1995 and Gupta et al.,2000).

Milkanova et al. (1995) studied that yield of pea increased with the use of P-Solublizing inoculants in the absence of fertilizer to a level similar to that obtained with 41 kg P/ha alone.

Phosphorus application greatly improves the yield attributes (pods per plant and seed per pod) and seed yield in french bean (Ahlawat, 1996) and in pea (Sinha et al. 2000).

Sharma and Mandeo (1996) observed that nodulation per plant, seeds per pod, 100 seed weight and seed yield were highest with 75 kg P/ha and rhizobium + FYM + PSB in soybean and pea. Kumrawat (1997) also reported that seed yield and test weight of pea increase significantly
due to the application of Rhizobium, phosphate solubilizing microorganism and N-P-K fertilizers. However, Marzo et al. (1997) observed that the lack of significant P fertilizer effects in seed weight and number of seeds/pod in peas.

Increasing rate of phosphorus (0, 40,80 or 120 kg ha') levels to pea crop resulted in a corresponding increase in yield and yield parameters. Similar results with phosphorus application have been reported by Parsad et al. (1989), Sharma et al. (1997), Dubey et al. 1999, Verma et al. (1997) and Gupta et al. (2000) in pea.

Sinha et al. (2000) also reported that phosphorus application greatly improves the yield attributes, i.e, pods per plant and grains per pod. However, Amjad et al., (2004) stated that seed yield and 1000 seed weight were significantly increased with increased level of P₂O₅ and K₂O applications up to the dose of 69+100 kg ha⁻¹, respectively.

Sundara et. al. (2004) noticed that the application of 80 kg P₂O₅/ha resulted in the highest number of seeds per pod (5.74) of pea.

**2.1.3. Effect of phosphorus on quality characters**

Bressani and Elias (1980), Marzo et al. (1997) reported an increase in protein content with increased P application. Jakobsen (1985) reported that the nutrient content of a given organ depends on its sink strength for that particular nutrient. However, Tosum and Sever (1992) reported that P fertilizer did not significantly effect seed yield or protein content.

Rao and Reddy (1997) and Singh et al. (1981) observed that increases in root dry weight, number of nodule, crude protein rate and phosphorus content of seed by the application of phosphorus up to 90 kg P₂O₅ ha⁻¹.

**2.2. Response of varieties**

**2.2.1. Effect of varieties on growth characters**

Rajput (1994) observed that application of 50 kg P₂O₅ per ha increased the yield and
quality of pea varieties. Significant effect of P was observed on growth and yield components, viz., plant height, leaves per plant, root depth, nodules per plant, pod per plant and seeds per pod except for 1000-seed weight.

Singh (2001) studied feasibility of vermi-farming in pea nut and vegetables pea (*pisum sativum*) cv. Azad P-1 cropping system and reveled that groundnut and vegetable pea performance could successfully be raised under sequential cropping by the use of FYM at 100 q/ha + Vermi culture 13.20 q/ha for ground nut and N15 + P10 kg/ha as a starter dose for vegetable pea, besides better management of natural resources of residue for higher productivity and monetary return.

2.2.2. Effect of varieties on yield and yield attribute characters

Subramanian *et al.* (1977) did not find significant difference between 25 and 50 kg P$_2$O$_5$ per ha in increasing the grain yield of pea cultivars. Application of 25 kg P$_2$O$_5$ per ha was found significantly superior in increasing the number of pods per plant and number of grains per pod. Chandra *et al.* (1989) reported that application of phosphorus to pea cvs. Pea-116 and T-163 resulted in increased 1000 seed weight.

Singh and Bajpai (1991) reported that mean yields were 1.46, 0.84 and 0.68 t/ha in cv. Khaperkheda, IMI and Bonneville, respectively.

Kumar and Rao (1992) observed that without applied P, seed yield was highest in CV. DMR-17 and lowest in Cv. Rachna, while when P was applied yield was highest in Cv. DMR-19.

Yadav *et al.* (1996) reported that peas cv. Lincoln, Bonneville, GC – Kil and kinnauri were given 0-9 kg p/ha. Application of P$_2$O$_5$ increased pod yield/plot at the highest application rate. However, Gupta *et al.* (2000) had already reported that increasing rate of phosphorus levels (0, 25, 50 or 75 kg ha$^{-1}$) to pea cv. Bonneville resulted in a corresponding increase in yield and yield parameters such as pod length, number of grains per pod and pod weight.

2.2.3. Effect of varieties on quality characters

Jabeen *et al.*, (1988) reported that cultivar arkel numerically produced greater protein
contents (232.3 g kg-1 or 23.23%). Different cultivars studied in the country contained 20-22% protein. Therefore, the resultant figures of all four cultivars are at par than those reported by Lukina (1990) but are found lesser than those 158 cultivars of pea.

Khushwaha and Chandel, (1997); Sugimoto et al., (1998); Achakzai and Kayani, (2002) and Achakzai et al., (2003) observed that maximum protein content (248.1 g kg-1) was recorded in increasing levels of phosphorus in arkel cultivar of pea.