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Economics of chickpea (*Cicer arietinum L.*) Production in India: A Descriptive View

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Abstract
This review paper attempts a systematic analysis of chickpea production in India. The main purpose of this view analysis of the socio-economic traits and costs & returns of chickpea production in across the country various groups of farms. The review is based on 45 research papers and focus on the assessment of socio-economic condition, education, annual income, enhancing living standard and also cost of cultivation of the chickpea producing farmers in across the country. Our findings can act as a useful reference for the researchers and provide insights for directing future research on economics of chickpea production of the Uttar Pradesh as well as Country.

Keywords: Condition, education, annual income, enhancing living

Introduction
Chickpea (*Cicer arietinum L.*) is the most important pulse crop, which is commonly known as "Gram" or 'Bengal gram, its, play an important role in food security, nutritional security, income security and environmental sustainability, besides of their nutritional value, it's enhance the fertility of soil in terms of yield of subsequent crops (Srivastava *et al.* 2010) [1]. It also provides a good amount of energy, protein, soluble and insoluble fibers etc. The chickpea contains essential amino acids i.e. lysine, methionine, threonine, valine, isoleucine and leucine. On an average, the 100 g of chickpea grains contains protein-14.50 g, carbohydrate-45 g, fat-4.20 g, sugar-7.90 g, dietary fiber-2.50g, phosphorus-447mg, iron-12.30mg, calcium-280 mg and calorific value-268 kcal. The Recommended Dietary Allowances (RDA) of chickpea seed for adult male and female is 60 g and 55 g per day; it has richness in fiber, minerals (phosphorus, calcium, magnesium, iron and zinc) and β-carotene (Reddy *et al.* 2009 and Kumawat *et al.* 2017) [2, 3].

Globally 50 countries are cultivating the chickpea and covering area of 14.56 million hectares, production is about 14.78 million tonnes and productivity is about 1014.6 kg/hac (*FAOSTAT*, 2018) [4]. India is the largest producer of chickpea which contributes (64.47%) of total chickpea production in world. While, area covering under chickpea 11.97 million hectare and production 9.53 million tonnes. The total food grain production is about 233.95 million tonnes in 2022-23, out of which only 27.81 million tonnes was contributed by pulses (3rd Advanced estimates 2022-23 DAC & FW) [5]. The production of food grains increases about 6 times since 1950-51 but the production of pulses in the country has increased only about 3.78 times. Thus, the per capita per day availability of pulses has proportionally declined from 71 gm, 1955 to 36.9 gm 1998 against the minimum recommended requirement (MRR) of 70 gm per capita per day. There is not much possibility to the import of pulses to fulfill the recommended requirements of the country. Hence, need to expansion of area of major contributing pulse like chickpea and adequate supply of improve varieties can meet out the demand?

In India, the Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Gujarat, Andhra Pradesh and Karnataka are the major chickpea producing states sharing over (95%) area. During last five decades, chickpea has registered significant increase in production (3.53%) average annual growth rate for 1950-2012, which is primarily due to introduction of high yielding and diseases resistant varieties and adoption of improved production technologies.

During last ten years, the productivity of chickpea has increased @ (1.74%) but the gross chickpea production has gone up by (6.32%), in addition the growth in area @ (4.43%) with accelerated growth rate and steps taken by the government under National Food Security Mission. The target of 10.22 million tonnes of chickpea production by 2030 can be achieved, successfully. The production statistics of major chickpea growing states like Madhya Pradesh has produced 4.59 million tonnes of chickpea, followed by Maharashtra 1.83 million tonnes, Rajasthan 1.68 million tonnes, Karnataka 0.78 million tonnes, Andhra Pradesh 0.58 million tonnes, Uttar Pradesh 0.57 million tonnes and Gujarat 0.37 million tonnes. Whereas, the productivity of chickpea is highest in Gujarat 1285 kg/hac followed by Madhya Pradesh 1280 kg/hac, Jharkhand and Uttar Pradesh 1155kg/hac 1228 kg/hac (DAS&CI, Govt. of UP and DES GoI., 2018) [6].

To explore the socio-economic traits of chickpea farmers

The economics of chickpea growers reported that the factors influence types of employment of workers in rural area, he has variables for the study are total assets (land cultivated), social group, religion, educational level, age (experience), and other regional factors of the workers. The education level has significant impact on the choice of non-agricultural employment, special in services and regular employment, in this study. As expected, income, size of land holding, state of being regular employee in non-agriculture is negative associated with part-time employment compared to full-time employment. However, the self-employed are spread among all income groups, and within the self-employed, there is not much difference in income between the agriculture and non-agricultural sectors. The self'-employed in non-agricultural sector are widely distributed in all educational and income classes as the self-employed in non-agricultural sectors constitute a heterogeneous lot, that is, it ranges from traditional handicrafts which are mostly in distress condition, due to lack of demand, low productivity, low technology, less capital to newly emerging sectors in rural areas like trade, transport which are demand driven (Reddy and Kumar 2006)[7]. The chickpea is a most important pulse crop that is an integral part of sustainable production systems of the country. It is very helpful improve the soil fertility, soil productivity for coming crops, environmental security of the chickpea grower's lack of knowledge about soil treatment, high yielding varieties, bio-fertilizer, and critical stage of irrigation. However, the lacking of scientific package of practices due to awareness of recommended doses of manures and fertilizer, bio-fertilizer, seed rate, high yielding varieties, spacing and method of sowing. Farmers was facing the problem arises due to poor socio-economic condition of the chickpea growers, communication and psychological factors had significant positive relationship with knowledge level of chickpea growers except age, farm mechanization, and size of land holding. The cosmopolitans, attitude towards chickpea production technology, economic motivation, scientific orientation, extension participation, and mass media exposure and information source utilization were the important factors which had direct and indirect effect on knowledge of chickpea growers *(*Shakya *et al.* 2016) [8]. India is the first largest producer and consumer of the pulses in the world, however, production of pulses such as chickpea, pigeon pea, field pea, black gram and green gram production has been decline about 12 and 15 million tonnes during 2015-16. While the current production is about 23 million tones and the per capita pulses consumption over the years is continuously going down from 61gm/day in 1951 to 30 gm/day in 2008. The administered price such as MSP has announced twice in year i.e. kharif and rabi by CACP is not effective for pulse crops and prevailing market prices. He also emphasizes of the increases the production area under short duration varieties, development of multiple disease and insect-pest resistance varieties, increase in area under Rabi pulse crops. Which could be lifting the pulses production as well as improve the soil microorganism i.e. rhizobium culture very helpful and fixing the environmental nitrogen into the soil *(*Reddy, 2009)[2]. It was also accounting about (25%) of global production, (27%) of global consumption and about (33%) of the world's area under pulses. Pulses, which play an important role in food and nutritional security and environmental sustainability, have shown a grim picture of their production performance both spatially and temporally. In the light of increasing the population growth, poor production performance has resulted in reduction in per capita availability of pulses which together with undue price rise has distorted consumption pattern of households. The study has explored the growth and dynamics of production and consumption of major pulses in different states of India and has made a comparative evaluation of key economic factors affecting their production in the study area (Srivastava *et al.* 2010) [1]. It had given emphasis to the all the pulse crop are playing vital role in the nutritional security and soil domestic able (physical and biological) properties have been an integral part of the sustainable agriculture since ages. However, the production of all pulses has drastically come down in the period, 1990-91 to 2007-08. Due to the hoarse climatic condition and area declined of winter pulses like lentil and chickpea in this period the approximately 5 thousand hectares has reduced of booth the pulses according to data of Directorate of Agriculture, 2008. Thus, the reasons for declining the pulses were most of the farmers are economically inefficient in producing pulses in the region. While the chickpea and pigeon pea helpful in reducing the use of chemical fertilizers and also enhances the output of paddy and wheat obtained significantly. The secondary data on area, production and productivity of chickpea in Amravati district, were collected from various issues of epitome of agriculture and district socio-economic review data of period of 20 years i.e. from 1990-91 to 2009-10. The performance of chickpea was examined by estimating the growth rates and co-efficient of variation of area, production and productivity of chickpea. The results revealed that, compound growth rates for area, production and productivity for period II were found positive and significant. The co-efficient of variation indicated that, instability in chickpea area exhibited less variation than production and productivity at overall period. Whereas production witnessed highest instability as compared to area and productivity at overall period (Pichad *et al.* 2014)[9]. It had reported that the global food and feed demands have been projected to double in the 21st century, which will further increase the pressure on the use of land, water and nutrients. However, the increase food productivity, production potential and economic returns, improvement of cropping system may play a vital role in this regards. The study was conducted to determine the economic consequences of two cropping patterns *viz*., Improved Cropping Pattern (Chickpea-T. Aus-T. Aman) and Farmer's Existing Cropping Pattern (Fallow-T. Aus-T. Aman) through incorporation of modern high yielding varieties and improved management practices for crop production at farmers' fields of Sylhet during three consecutive years 2009-10, 2010-11, and 2011-12, respectively. The experiment was laid out in randomized

complete block design with six dispersed replications. The pooled data showed that the improved management practices for the pattern provided higher yield in T. Aus and T. Aman rice, respectively. The gross return and gross margin of ICP were higher compared to that of FECP with only (21%) extra cost. The higher benefit cost ratio (2.20), rice equivalent yield (10.29 t/ha), production efficiency (27.36 kg/hac/day), land-use efficiency (91.32%) and sustainable yield index (0.41) indicated the superiority of the ICP over the FECP. Higher rice equivalent yield indicate that ICP is suitable in Sylhet region for increasing crop productivity and cropping intensity (Shaheb *et al*. 2014) [10]. The pulses providing nutritionally balanced diet and major sources of the protein for non-vegetarian population. India is the largest producer, consumer and importer of pulses, while the data indicates the area of pulses occupied 26.28 million hectares which contributed production 18.10MT during 2010-11. However, the growth rate of pulses area and production were found negligible as compared to cereal like wheat and paddy and there exit wide inter states variability in their yield in the country. The growth rate of area 0.09, 0.60 and 1.62 and production 1.52, 0.59 and 3.35 during 1980s, 1990s and 2000s decades, which are affected per capita per day availability of pulses, has declined sharply from 61 gm to 32 gm from 1951 to 2010. Therefore, the gap of domestic demand and supply widen sharply due to quality seed, lifesaving irrigation, fertilizers and nutrients, price policy implication and marketing to be reoriented to bring it in tune with the emerging demand and supply of pulses in country (Narayan *et al.* 2015) [11]. It is also explained that the pulses are an integral part of Indian agricultural economy next to cereals and oilseeds in terms of acreage, production and economic value. It has rich source of protein and energy, but in the country pulses has cultivated under the poor soil conditions, un-irrigated land resulted poor pulse productivity. The studied has also arises the major problem unavailability of quality of seed during sowing time and cultivated on marginal & sub-marginal lands, imbalanced use of fertilizers by farmers. They could not adopt modern production technologies and good management practices due lack of awareness and illiteracy. Hence the potential technologies in pulse production including improved seed, integration facilities and management of insect pest etc., could be lifting the production, productivity and profitability, it has also increase the environmental, social sustainability of the nutritional security. Another studied suggested that the improve the cultivation practices, such as increase the seed replacement with improved varieties, raised bed planting method, use of bio fertilizers, foliar application of fertilizers at critical stages in rainfed areas, application of secondary, micro-nutrients, integrated weed and insect-pest management etc (Pooniya *et al.* 2015) [12]. The socio-economic characteristics of chickpea growers in the study area, which shown that about (40%) of farmers were large categories followed by small and marginal farmers. It has also identified the proportion of population such as male and female in sample households were found to be nearly (52.50%) and (47.50%) respectively. The majority of female workers engaged in household works but a substantial proportion was also engaged in agriculture, which was indicating that proportion of farmers approaching research seed or improved seed of chickpea production (Kumari *et al.* 2015) [13]. The poor food nutritional value, particularly lacking in micronutrients, recognized serious health problem in developing countries including India. Till now Nutritional security is a priority for human being and crop diversification in Indian agriculture system and the production intensification and nutrient contributes to maximum production of among the pulses. It has rich in proteins, minerals and essential micronutrients for growth and development. Some countries have successfully use for food supplements for children and elderly, as well as to prepare ready to use the rape tic food products to treat acute malnutrition and consequently the poor people could be access to legumes at affordable prices. The pigeon pea (*Cajanus cajan* L.), chickpea (*Cicer arietinum* L.) mainly two nutritious grain legumes are grown widely across the country and globe has major constituents of Indian diets. They are climate-resilient crops adapted to water-limiting conditions making them choice crops for cultivation in adverse conditions (Janila *et al.* 2016) [14]. The rainfed area of the country has characterized by its complex nature, diverse ecosystem, hoarse climatic condition and distress production system. It has estimated that about 11.69 million hectares in India remains fallow land after rice harvest, of which around (82%) lies in the Eastern part of India. These areas have a vast potential to cultivate low input and low water requiring upland for pulse crops (lentil, chickpea, lathyrus, mungbean and uradbean). However, depletion of soil moisture content when rice harvest affects timely sowing and receiving in of poor returns out of these ecosystems and owing to lack of life saving/supplementary irrigation at critical stages causes further soil moisture scarcity and crop productivity. There were two cropping systems *viz*., relay cropping of pulses in standing rice, and crop rotation after harvest of rice have potential for popularization and adoption depending on agro-ecosystem involved. Keeping of the view of these facts, some potential management considerations involving suitable pulses varieties, zero tillage, lifesaving irrigations and foliar sprays of nutrients were suggested that could help in improving pulses productivity under challenging rice fallow conditions (Singh *et al*. 2016) [15]. The adoption of the seed by the farmer and production technology was positively influenced socio-economic profile of the farmers such as his education, age, land holding, irrigated land, number of crops grown, and extension contacts while family size was influencing negatively. It has also shown that the higher yield and profitability associated with seed production can be effectively in all farmers and provide sufficient results for certified seed production. Thus, the increased the area and certified seed production and average land holding size of pigeon pea seed producer farmer was higher in comparison to farmers and district average. They analyzed the ratio of 32:68 towards fixed and variable costs in pigeon pea certified seed production with a total cost of Rs. 39436 and the gross and net returns were Rs. 73300 and Rs. 33864/hac respectively. The total cost of cultivation, gross return, and net return in pigeon pea seed production were higher by around (23, 32, & 44%) than grain production, respectively. Hence, production of certified seed has resulted in a higher yield and increased returns of the growers (Pal *et al.* 2016) [16].

The pulses are complementary to cereals both in production as well as consumption. In the course of the production process pulses are very helpful in fixation of the atmospheric nitrogen into the soil, consuming less water, controlling diseases and pests and improving sustainability of the land. It has reduced the malnutrition and improves human health being a rich and most viable source of protein for vegetarians and poor people. Realizing the importance of pulses, the government of India announces various schemes and programs from time to time to promote the cultivation of pulses in the country. However, the studied suggested to

measures the farm level profitability and sustainability by increasing technical efficiency. Thus, the technical efficiency of the pulses is very low and the yield potential of the pulses is not fully harnessed by the famers and increase of technical efficiency by (1%) will reduce the yield gap by 9 kg/hac (Jain *et al.* 2016) [17]. The structure and nature of cropping pattern, crop concentration, productivity level in the study area, it is revealed that the cropping pattern changing trend in study area. The area under rice has increased from (48.10%) of gross cropped area of the state in 19980-1985 to (55.60%) in during 2000-2005. There is marginal increase in the area under cash crop and it can be observed diversification as reflected through the periodical changes in the cropping pattern of around ten crops although the number of these specified crops is small and the total share of area is high among individual crops rice has occupied highest share in the study area and this has increased over time in two and half decades under consideration (Nayak, 2016) [18]. Bundelkhand is a major pulses growing region of the country. Thus, the livelihood of farm households in the region dependent on the agriculture and particularly as well as pulses as one of the major cultivated crops and pigeon pea, urad bean, and mung bean cultivated during kharif and chickpea, field pea and lentil cultivated in rabi season. The Madhya Pradesh about 90% farmers were used high yielding seed of pulses, application of DAP and pest management done by all the farmers and (70%) farmers of Utter Pradesh faced the problem of access the quality seed while (70%) farmers of Madhya Pradesh obtained lack of knowledge about quality seed, non-availability of fertilizers problem in lentil crop, and problem of weed management reported by (60-80%) of farmers from all the district of Madhya Pradesh. Therefore, it could be concluded that access to quality seed, insect damage loss and menace of blue bull were the major constraints adversely impacted the pulse production in Bundelkhand region (Kumar *et al.* 2017) [19]. The pulses production and requirement in the country was estimated 23 million tonnes, projected requirement about 32 million tonnes by the year 2030, 39 million tonnes by the year 2050 and per capita availability is estimated at (41.60 g/day) which was quite low (31.80 gm) in 2000. This necessitates and annual growth rate of (2.20%) requiring a phenomenal shift in research, technology generation, its dissemination, and commercialization along with capacity building in borderline of research. It has also identified the cultivation of the pulse crops into the poor soils under rainfed conditions with minimum inputs these crops yield loss not only due to edaphic, Abiotic and socio-economic factors but also due to complicated various biotic or a biotic stress. In every five-year interval productivity enhanced about more than (80 kg/hac), over the previous one year to achieve a final productivity rate of (950 kg/hac) by end of 2025 and (1335 kg/hac) by the end of 2050. Therefore, for increasing production of pulses, intercropping systems found to more beneficial in comparison to sole cropping systems in respect to profitability and soil fertility (Kumawat *et al.* 2017) [3]. The analysis showed that the socio-economic characteristics of selected soybean farmers, the majority of the farmers were in 30 to 45 year age group (52.50%) whereas, (17.50%) belonged to up to 30 years age group and (30.00%) belonged to above 45 years age group. In respect of educational status (72.50%) respondents were attended high school and (15.00%) were educated up to college level, whereas (12.50%) respondents were found illiterate. The average size of family was (5 & 67.50%) respondents reported that they had (Primary) agriculture as a main occupation. Average size of holding of soybean growers was 2.83 hectare which is net sown area was obtained in 2.67 hectare. The percentage of irrigated area to total area was (28.27%) while percentage of rainfed area was (66.07%) and the cropping intensity was (145.69%), average area under soybean was 1.70 hectare respectively. The gross cropped area was found in 3.89 hectares (Perke *et al.* 2018) [20]. The global pulse production in the country need to take up these challenges by having real time field exposure to different segments of chickpea production and economics of pulse production has been grown in chickpea production in tropical countries has been found to be economically viable and farm diversification strategy and independent commercial activity, turning our attention on bio-economic modeling. The cross-price effects of chickpea based on agriculture products, effects of trade and non-trade barriers on these products, potential conflicts between the development of chickpea production for export and agriculture for subsistence consumption are the other serious concerns that need to be addressed.

In Indian context for the evaluation of the current status & prediction of future scenario of chickpea production and evaluation of the prevalent chickpea based agriculture technologies can be strengthened by specific farm technical-efficiency increase the production and productivity of the crop (Naz *et al.* 2018) [21]. The studied indicates that the socio-economic characteristics of the farmers in pigeon pea cultivation revealed that majority of the respondents were middle age (60.83%), highest percentage obtained and medium land holdings second largest characteristics obtained (55.83%), medium risk orientation (55.83%), medium scientific orientation (50.83%), medium extension participation (48.33%) medium income (48.33%) and low innovativeness (44.17%), medium farming experience (40.00%), and educated up to high school least obtained by researcher (37.50%), and maximum number of them used to seek information from mass media and medium level of sources of information (44.17%) all characteristics are very useful in the pulse production, enhancing the productivity of the cultivated land area and improvement quality of the seed (Melkeri *et al.* 2018) [22]. Pulses are known as cheapest source of protein for the vegetarian population in the country, there are 17 major pulses producing states in India. Uttar Pradesh has (9%) area and (11%) share in production in India, which stands fifth and fourth ranks in India. The Government of India launched the project in just beginning of the nineties for self-sufficiency in pulses production, and impact of the projected production was quite good and it has recorded (12%) as compared to (7%) as in pre period. The data were collected from data bulletins of Government of Uttar Pradesh and India has analyzed the time series data on pulses crops like arhar, chickpea, lentil, field pea and total pulses for four economic regions from 1970-71 to 2009-10. It has observed that the Bundelkhand region has a leading position in terms of area and production of chickpea. It has also found that the only Bundelkhand region continue alone with valuable contribution of area and production of the state. Chickpea is the world's third most important food legume with (96%) cultivation in the developing countries and Uttar Pradesh is the fifth rank in chickpea production. The independent variables like, education, size of land holding, annual income, sources of information utilized and training had positive and significant association with the knowledge level of the respondents at (1%) level of probability. The majority of (73.61%) respondents had medium level of overall knowledge

level, major knowledge about sowing method (98.10%), harvesting time, method & handling (88.17%), suitable soil (83.10%), storage observed (81.70%), land preparation (80.55%) and sowing time (78.20%). Besides of these the extension contact has been positive and significant association with the knowledge level of the respondents has increase the yield and income at (5%) level of probability (Rajbhar *et al.* 2018) [23]. Pulses in the Uttar Pradesh has decreased from 49 lakh tones (1995) to 27 lakh tones (2009) and yield has decreased from 17 qt/hac (1995) to 10 qt/hac (2009) respectively. While the Bundelkhand region of Utter Pradesh was found as dominant in pulse production with about 11 lakh hectares of area under pulse cultivation and 16.86 lakh tones production in triennium ending 2009, However the production and consumption of pulses in India is low with inter-regional variations and the growth rate of area and production of pulses is negligible as compared to cereals. Growth rate was also highest in Bundelkhand region in 2000-09. It has also identified the percentage share of pulses in consumption basket was not uniform among the regions and show inter-regional variations (Hasan *et al.* 2018) [24]. Further evaluated the impact of mechanization in pigeon pea cultivation., The mechanization has lead the saving of human labour to the tune of 39.33 man days and 20.00 pair days of bullock labour by using additional 25.18 hours of machine labour and the mechanized farms made a human labour cost saving by Rs. 7881.87. The mechanized farms used to slightly fewer the judicious quantities of inputs as compared to non-mechanized farms. The yield was obtained to be higher in mechanized farms (17.92 qt/hac). Total output decomposition model revealed that mechanized farms produced (35.37%) higher income in pigeon pea than non-mechanized farms. The mechanization only contributed (35.99%) increase in farmer's income, while fewer labour uses of inputs depressed the income marginally. While the objectives of the farmer's increase to soil fertility and soil productivity show improvement of the production and farmers gain maximum profit of the cultivated crops (Patil *et al.* 2018) [25]. The climatic abnormalities impact on changes in area and productivity after 3 decades of different agro-climatic regions and mitigation technologies on yield and benefits of chickpea. The absolute and relative changes in area was increased by 627.67 thousand hectares and (40.70%) against base years (1980 to 83) area 1541.74 thousand hectares, and increased in productivity by (178.33 kg/hac) and (37.90%) compared with base year yield (471.00 kg/hac), respectively. The all agro climatic regions showed prominent disparity in area and productivity the highest area increased in Malwa plateau (420.03 thousand hac), whereas decreased in Satpura hills (57.43 thousand hac) compared with base year. The trend of relative changes was obtained in area maximum of Jhabua hills (241.18%), while decreased in Satpura plateau (24.55%). However, the relative changes in productivity were improved of the Gird region (128.44%), whereas decreased in Vindhyan plateau (14.40%) compared of base year adoption of the new technology neutral effect of climatic abnormalities. Hence, the increased the soil moisture through winter rains or faulty irrigation which leads increases plant growth and improvement of the soil structure under these conditions and pulses are increased the soil fertility through the environmental nitrogen fixation Similarly, using improved techniques for mitigation of climatic abnormalities gave maximum net returns and B: C ratio contrast to control (Singh *et al.* 2018) [26]. It was examined the significant impact of age, experience in cultivation, education, annual income, labour resources, majority (59%) of the farmers belongs to the age group 35-50 and nearly (26%) (77) Belong to the age group of above 50 years. It's interesting to know that (54%) of the farmers are from secondary to Intermediate., Only about (17%) can have ability to read and write as per the present data and (23%) of the farmers have less than 15 years of farming experience, (44%) with 15-30 years and (34%) had more than 30 years of experience in farming. The only (10%) of the farmers have less than Rs.50000 as their annual income (62%) of the farmers have about Rs.50000 to Rs.75000 of income and early (28%) of the farmers getting more than Rs.75000 per annum from farming processes. This could be because of the portion of land holdings, or low yield from high portion of land holdings too. The land cultivated by most of the farmers (52%) range from 3-4 acres. (33%) of them have either 1 or 2 acres of land and nearly (15%) possessed more than 5 acres of land. It's very interesting to finding from analysis that (66%) of the farmers are cultivating under irrigated conditions whereas only (10%) of them depend on rainfed. Although, (24%) are cultivating under both the conditions, regarding the labour facilities, majority farmers (87%) conveyed their adjustment with somewhat adequate labour resources whereas (13%) are suffering with inadequate labour resources (Ramana *et al.* 2019) [27]. It was also examined the generation ability, possibility to raise the cropping intensity due to its nature of best fit with food grain production system. The lentil crop was also allotted considerable acreage in cropping pattern; cropping intensity was found inversely related with farm size. Paddy, wheat and sugarcane were the major crops of the kharif, Rabi and zaid season respectively. The overall average cropping intensity came to (233.17%) and marginal, small and medium size group cropping intensity was found (240.06, 224.19 & 198.98%) respectively. The overall availability of average size of land holding was found (0.419 hac) in different size of groups and marginal, small and medium size group of land was found to (0.292, 1.463 & 3.548 hac) respectively. The whole cultivated area was found in irrigated condition in different size of groups. Similarly, per farm and per hectare investment on building and livestock were also inversely related with farm size Land is the base for any agricultural enterprise the total farm assets available i.e. buildings, machinery & implements and livestock in different size of groups. The overall average total farm building was found (63.53%) followed by machinery & implements (27.17%) and livestock (9.29%) (Shankar *et al.* 2019) [28]. The cereals and grain legumes are the staple and cash crops providing nutrition and cash to the smallholder farmers. The intercropping of these crops is more common than rotations in the study area but options to optimize benefits from these practices are underutilized or unclear to the small holder farmers. In this review, options for intensification of cereals and grain legumes optimize productivity of the crops in mixtures. The primary benefits derived are related to the greater resource capture through uptake of nutrients and utilization of light and water. Resource facilitation and complementarily explain the mechanisms by which crops in intercrop benefit each other. The rotations and intercrops, grain legumes have 'N-effects' and 'non-N-effects' effects on subsequent cereal crops. Grain legumes also supplement dietary protein and the surplus from both crops is sold for cash generation. Rotation and intercropping are the common farming systems of these crops on smallholder farms. The both practices are intended for improvement of system productivity on crop itself for food security and sustainability

of soil fertility, Land size used for crop cultivation, socio-economic differences, climatic conditions, access to agro-inputs and seasons of the year affect the type of cropping system to be practiced. The overall performance of these farming activities, ownership of assets from farming, and marketing of surplus products is gender driven although women constitute the most vulnerable group in the system, escalating an area for further investigation and need for sensitization (Nassary *et al.* 2019) [29].

Pulses are an integral component of agriculture particularly in subsistence farming and the beneficial for coming crops which includes i.e. providing nutrition for both human beings and livestock production as well as improve ecosystem. They have an increased socio-economic impact with the ongoing changes in climate and predicted to reduce the incidences of drought; pulses are more reliable to sustainable agriculture. It has also found the soil was most versatile because variability in cropping pattern and duration from early to late maturity. Thus the pulses improve both water and nutrient use efficiencies when included in cropping systems and it has play an important role in climate change mitigation through their ability to fix nitrogen, and decrease the dependency of organic and synthetic fertilizers. The crop production management technology involves judicious use of integrated nutrient management and insect-pest management; appropriate integrated management that includes pulses can be promoted to ensure sustainable crop production under the adverse effect of the climate change (Mashungwa *et al.* 2019) [30]. Chickpea is a considered as the second most important pulse crop of the common beans. It is cultivated in over 50 countries throughout the tropical, subtropical and temperate regions. The variables of socio-economic status of chickpea growers had revealed that the average age was found 54.64 years and marital status revealed the (96.67%) growers were married with average family size was found 8.25 members. It has also observed there (74.16%) of farm family were living as joint family and (92.50%) farm families belongs to Hindu community. Further the study revealed (70.83%) chickpea growers were literate (86%) growers were living in mixed and katcha house and the majority growers were engaged in the on farm activities, their average annual income was found Rs.134533 (Panday *et al.* 2021) [31]. The green gram is the third important pulse crop of India grown about (8%) total area of the country. It is designated as "poor man's meat" and creates the employment (21.28 & 31.58%) in low to medium and medium to high level of adoption and income (13.08 & 20.19%). However, the employment and income was increased from low to high level of the producers and net returns of Rs. 5332.54 were added in medium level of the producers as compared to low level of producers while the net returns of Rs. 9307.83 were added in high over medium level of producers. The IBCR was estimated to 1.26 and 1.73 for medium and high level of producers respectively and exists a yield gap of (48.73%) in green gram production. The Bullock labour, machine power and fertilizers in case of green gram provide highly positively significant at (1%) level of significance indicating the important variables for which output is responsive. Therefore, it has recommended that farmers may adopt these technologies at improve the higher level of the productivity of green gram (Khairnar *et al.* 2019) [32].

To determine the costs and returns of producing chickpeas across various groups of farms: It was analyzed the cost of cultivation, profitability and production in different group size of farms in the study area, the variable costs was found Rs. 21506, Rs. 20560 and Rs. 20748/hac in small, medium and large size farmer groups. Where, as expenditure on fixed cost from smaller to larger one are obtained was Rs/hac Rs. 12644, Rs. 15357 & Rs. 15929 increasing trend was visible. Total cost *i.e.* some of variable and fixed costs were obtained Rs/hac. From smaller to larger one are Rs. 34150, Rs. 35957 & Rs. 36677 shows increasing trends. The total cost incurred was maximum by the large farmers followed by medium and small farms and Gross return Rs/qt. was Rs. 63622, Rs. 70030 and Rs. 79799 along with net return formed Rs/qt. was Rs. 29472, Rs. 34073 and Rs. 43122 in between small to large size group shows increasing trends. The benefit cost ratio was 1:1.86, 1:1.95 and 1:2.8 from small to large size group. Green pea are main cash crops grown by the farmers in this area because the farmers formed that this crop are to more profitable than other crops. The gross and net returns have been found higher in large forms due to realization of higher prices. Fertilizers irrigation and other operations have been made the impact variables, influencing the increase in the yield of green peas positively. The study concludes that there should be a chance of minimizing the costs. Hired human labour charge and applications irrigations fertilizer and plant protection measures would be minimizing up to an optimum level all in future. All packages of practices should be applying thoroughly and properly in a good frame of time work casting a greater yield with better quality (Verma *et al.* 2015) [33]. The cost of cultivation evaluated wheat and chickpea production based on primary data collection. The cost of cultivation of wheat was highest found (Rs. 28037.18/hac) in comparison to chickpea (Rs. 23899/hac). The variable cost was found (57.86%) and (55.46%) of the total cost of wheat & chickpea cultivation respectively. He has also identified the Cost A_1 was (56.87%) and (55.15%) of the total cost of wheat & chickpea respectively. While the family labour, seed have a positive and significant impact on the productivity of wheat and only fertilizer has positive and significant effect has seen the productivity of chickpea. The 0.554 and 0.616 returns to scale from the cultivation of wheat & chickpea respectively shown the decreasing return to level the gross income, net income, farm business income, farm investment income, contribution margin and benefit cost ratio of wheat were more than in comparison to chickpea. It has reported that the benefit-cost ratio was higher in wheat (1:2.18) compared to chickpea (1:1.97) respectively (Verma *et al.* 2016) [34]. The redgram costs and returns estimated that the total cost of cultivation for small, medium and large size of farms were (Rs.39792.2/hac, Rs.38504/hac and Rs.37003.8/hac) respectively. While the gross returns of large size of farms were high (Rs. 86025/hac) as compare to medium farms (Rs.83250/hac) and small size of farms (Rs.80475 /hac) respectively. The net returns per hectare were highest in large size of farms (Rs. 49021.20/hac) as compare to the medium and large size of farms (Rs.44746/hac and small size of farms (40682.8/hac) respectively and input-output ratio was obtained highest in large size of farms (1:2.32) compare to medium and small size of farms (1:2.16 and 1:2.02) (Kumar *et al.* 2017) [35]. The costs and returns of the chickpea growers where (70%) of chickpea producer was harvested by human labour and threshed it with machine and remaining (30%) of the respondent's used machine both for harvesting and threshing. On an average both states together, total human labour, bullock labour and machine hours utilized in the study areas was obtained to be 33.66 man days, 5.39 pair days and 4.69

hours, respectively. Although the quantities of inputs used were less per acre, the total expenditure incurred on these inputs was more in case of Maharashtra (Rs.13443.88/hac) as compared to Madhya Pradesh (Rs.12133.73/hac). The benefit-cost ratio indicated that chickpea cultivation was obtained to be economically viable for respondents in the study area and net profit of mechanical harvesting and threshing over manual harvesting and machine threshing was Rs. 2613 and Rs.3044 in Maharashtra and Madhya Pradesh, respectively (Shilpa *et al.* 2017) [36]. Chickpea is one of the major pulse crops in Bihar and its average productivity 1000 kg/hac it is also significantly higher than the national average of 841 kg/hac the production of chickpea. The study also revealed that the average productivity of improved variety of chickpea in adopted villages ranged between 950 kg/hac and 850 kg/hac for local varieties. The per capita income in the adopted village is more than that of control village which (54%) of income derived from the crop enterprises and cost benefit analysis indicated that pulses crop are more remunerative crop for Banka district compared to Bhagalpur district (1.60) as benefit cost ratio for local varieties was higher (1.90) in Banka. But for improved verities it was estimated higher in Bhagalpur (2.01) (Kumari *et al.* 2017) [37].

The economic analysis of chickpea, the average cost of cultivation of chickpea obtained in Rs. 35016.38/hac. While on an average rental value of owned land (22.84%), total human labour (21.41%), manure and fertilizers (9.00%), irrigation charges (0.64%), machinery charges (15.00%), plant protection (1.71%), seed (21.41%), interest on working capital (2.81%), interest on fixed capital (2.43%), and depreciation on fixed capital (1.47%) and land revenue (0.03%) obtained respectively. The major operational cost chickpea was obtained as Rs. 7500.00/hac and cost of seed/qt. was incurred of Rs. 3668.85 respectively. However, the input output-ratio of chickpea was found 1:2.67. The study has also suggested that there is an urgent need to increase the seed production of improved cultivars to ensure adequate availability of quality seed to the farmers at local level and at affordable price (Kumar, 2017) [38]. One more Studies reported the pulses are play in crucial role for food, nutritional security and also income and employment generation ability possibility to raise the cropping intensity due to increase food grain production and collected sample farmers belonging to marginal, small and medium land holding. The population and education status of the selected farmers were inversely and directly related with farm size and more than (50%) of the collected sample farmers were owner of marginal holding very less number of medium size farmers were reported in the study area. Costs and returns analysis of these crops shows that arhar was most profitable crops reported in the study area (Singh *et al.*2018) [39]. The gross return which is the best indicator of profitability, the results of the studied obtained that although pulse cultivator has been obtained to be profitable in this study area. The highest cost is incurred under gram cultivation in this study Rs, 7828.11 and 5190.28/acre followed by the cost Rs, 7500.85 and Rs, 4343.91/acre under moong cultivation respectively. The cost of cultivation has been obtained in lowest Rs. 6256.69 and Rs, 4425.60/acre under gram reported in the study (Kaur *et al.* 2018) [40]. The study reported that the chickpea is one of the important crops of Uttar Pradesh as well as, in India has ranks 1st in world in chickpea production. The country total food grains production was about 257.4 million tonnes out of 257.4 million tonnes 19.3 million tonnes contribution of the pulses in 2013-14. It is expected that chickpea cultivation is suitable for upgrading food security mission of India, as well as, suitable for doubling the farmer's income. The overall average, cost of cultivation was reported by Rs. 27819.43/hac in the study area and the cost of cultivation also shown the positive relation with size of holding as it was obtained maximum on medium farms (Rs. 29536.05/hac.). The overall average, cost of production was estimated by Rs. 2467.42/qt. in the study area and overall average, input-output ratio came to 1:2.46 to 1:1.53 on the basis of Cost-A and Cost-C. While the overall average, net income and gross income reported Rs. 14760.57/hac and Rs.42580.00/hac in this study area (Sengar *et al.* 2018) [41]. Pulses are an important crop with the view of their food and nutritional security and also income and employment generation ability possibility to raise the cropping intensity due to its nature of best fit with food grain production system. The maximum percent share of the cost is constituted by seed i.e. (23.70%) followed by human labour, machinery charges, and fertilizers corresponding to (23.34, 13.37 & 7.26%) respectively. The average costs of the cultivation of gram on different categories farms are also mentioned in which maximum of Rs. 34016.20/hac on small size of farm followed by marginal and medium size of farm corresponding to Rs. 33657.33/hac and Rs. 32470.80/hac respectively. The average cost of production per quintal obtained about Rs. 1497.94, while the higher per hectare cost of cultivation on marginal farm was funded and total costs of cultivation and gross income per hectare were positively related with size of farms. However, the negative trend of net income with farm size should that resources are not efficiently used in gram cultivation at larger size group of farms (Singh *et al.* 2019) [42]. It was estimated that the cost of cultivation in green gram of sample farms. The result was found that the overall costs A, B, C were Rs. 24841.20/hac Rs. 38294.47/hac and Rs.41637.98/hac respectively. While the major items of cost of cultivation incurred such as machine charges, rental value of land, seed cost, fertilizers and manures etc. The average per hectare yield and gross returns maximum on large and medium farms and an overall human labour, manure, nitrogen and phosphorous obtained significant while, nitrogen and phosphorous obtained significant at all size group. The average per hectare net profit at Cost-C was Rs.11735.39/hac. The input output ratio at Cost-C was 1.28 at overall level indicated green gram cultivation and also reported the profitable enterprises (Kantahle *et al.* 2019) [43]. The overall average size of land holding in the study area was 0.81 1.64 and 3.07 hectare in marginal, small and medium size of farms respectively. Whereas overall average size of land holding was found 1.95 hac and cropping pattern sown that the chickpea was first important crop which covered maximum area (18.82%) followed by til (14.45%), (11.70%), paddy (11.00%), Jowar (8.27%), Lentil (6.34%), Arhar (6.09%), Mustard (5.51%), Bajra (4.83%), Barley (3.52%) and other crops to gross cropped area (kharif, rabi & zaid) respectively. Cropping intensity decreased with the increase in the size of holding cropping intensity was (187.18%) on an average The maximum total cost was recorded on medium farms Rs. 35856.84 due to heavy expenditure on human labour, machinery charge, seed and rental value of land the per quintal cost of production of chickpea. The overall cost of cultivation per hectare was found to be Rs. 34353.35 and gross income and net income were found to be Rs. 55172.70 and Rs. 22666.81/hac on overall farm respectively. The overall cost of production was found Rs. 2802.07/qt and cost of production highest incurred in 2889.35 medium group sizes respectively (Singh *et al.* 2020**)** [44]. These studies also

analyzed the costs and returns of chickpea production in Banda District of Bundelkhand Region (U.P.). It attempts to estimates the cost of cultivation, cost of production and benefit cost ratio of chickpea crop of different group size of farms. The chickpea growers they were categorized into four groups on the basis of their size of land holdings. In this study chickpea cultivation indicates that the cost of cultivation, cost of production, net returns and Benefit Cost Ratio, which increases with increases the size of farms. The average of cost and returns indicates that the total of chickpea cultivation was incurred in Rs.35941.05/hac and net income was received Rs. 23103.82/hac by the farmers. Further the average Benefit Cost Ratio was estimated 1:1.64, which also indicates that per unit profits earn by the growers from chickpea production in the Banda District of Uttar Pradesh (Panday *et al.* 2021) [45].

Conclusion

The present study based on two major dimension first, socio-economic traits and second one had costs and returns of chickpea producing farmers in across the country various groups of farms. The chickpea is a most important pulse crop that is also integral part for sustainable production systems in the country. It is very helpful in improving soil fertility, soil productivity for upcoming crops, and also enhances environmental security of the chickpea growers in the country. But due to lack of knowledge about soil treatment, high yielding varieties, bio-fertilizer, and critical stage of irrigation farmers are unable to get the accurate returns of their investment. The study shows that the growth of chickpea as compare to rice and wheat in terms of technology advancement is very less due to awareness of recommended doses of fertilizer, seed rate, high yielding varieties and farmers are facing problem due to poor socio-economic condition. In the second, education status of farmers is directly related to the farm mechanization and use high yielding varieties, use of manure and fertilizer in a accurate manner. There is also need to conduct more studies that can critically analysis of economic aspect of chickpea farmers. In the upper level government has made many policies and schemes for farmers all round development, but due to illiteracy, socio-economic condition of farmers, farmers are unable to get the benefits of policies and schemes. Here is urgent need to develop farmers friendly schemes, so farmers can access scheme and improve his socio-economic condition.

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