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TRENDS AND PATTERNS IN PRODUCTION OF PULSES IN UTTAR PRADESH

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Abstract: *Agriculture in India is the backbone of economy. A large segment of India's population is depend on agriculture and allied activities for their sustenance. India is leading country in production of a few agriculture commodities. It is largest producer of milk, cashew nuts, coconuts, tea, ginger, turmeric and black pepper. It also has also the largest livestock population. It is the second largest producer of wheat, rice, sugar, groundnut and inland fish. It is the third largest producer of tobacco. It accounts for 10 per cent of world's fruit production. India has a comparative advantage in agriculture. There is considerable scope for raising farm income and employment through increasing agro-based exports without compromising the food security. Uttar Pradesh is characterized by abundant natural resources such as diverse agro-climatic conditions, varied soil type and abundance of rainfall which has immense scope for growing the varieties of pulses crops. Against this backdrop, the present present attempts to examine the growth trends in area, production and yield of pulses crops in Uttar Pradesh.*

INTRODUCTION

The data on area, production and productivity of different pulse crops as well as total pulses have been analyzed using different statistical tools and techniques keeping in view of the objectives of the study. Trends in area, production and productivity of different pulse crops and total pulses pertaining to the period 1994-95 to 2014-15 haven been analyzed. The emerging patterns in area, production and productivity of pulse crops in the geographical regions of state have been also analyzed in this chapter. Uttar Pradesh is known as agriculture prone area and the farmers are using crop production for their livelihood. Uttar Pradesh Agricultural Policy has adopted and emphasized the need for diversification of existing agriculture towards high-value crops and develop appropriate infrastructure to accomplish regional specialization in production of commodities best suited to their respective bio-physical endowment and improving the sustainability of soil and water resources (Fahimuddin, 2013). The Crop Diversification in Uttar Pradesh is one of the most important phenomena

The scenario of total pulses during last sixty years has been very gloomy. The area under total pulses has steadily decreased over every decade since 1960-61 onwards, and it has reduced to half, i.e. about 10 per cent at present from about 21 per cent in 1960-61. Among the pulse crops, drastic reduction in the area has been found under pigeon pea (3.00 to 1.30 percent), pea (4.44 to 1.19 percent) and chick pea (11.75 to 2.32percent) over last sixty years. In contrast to these pulse crops, lentil has gained its area from 0.84 per cent

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in 1960-61 to 2.29 per cent in 2010-11. This has been probably due to development of rust-resistance varieties of lentil which has grasped area of pea which is more sensitive to environmental variation and rust and wilt diseases. The other pulse crops, which mostly constitute the urd and moong, have experienced increasing trend in its area since 1960-61 onwards (from 0.90 to 2.48 percent). Traditionally the urd and moong were grown during kharif season. But, due to development of short duration varieties of urad and moong and its suitability is summer seasons the farmers started growing urad and moong in summer season, and consequently the area under these crops has started increasing since late seventies onwards (Sharma and Sisodia, 2018).

TRENDS IN AREA OF PULSES:

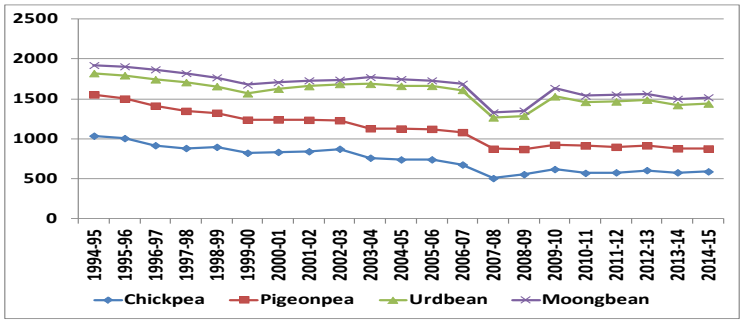
There has been negative growth rate in area, production and yield of total pulses in Uttar Pradesh during post-reform period (1991-2016) while it was found significant growth in production, yield and area under total pulses during pre-reform period (1980 to 1990). However, there has been nominal growth in area and significant growth in production and yield of total pulses in India during pre and post-reform period. There has been negative growth in area under red chick pea, Bengal chick pea and green chick pea in the state of Uttar Pradesh during pre and post-reform period. However, growth in production of red chick pea, Bengal chick pea, green chick pea was found significant during pre-reform period and remarkable growth was recorded both for pre and post-reform period in production and productivity of black chick pea in the state.

In Uttar Pradesh, pulses are largely cultivated in Bundelkhand region. Pulses occupied about 11 lakh hectare of area with production of 16.86 lakh tones in 2009 in Bundelkhand region. The Eastern region was found to be second largest contributor to total pulses area with 6.02 lakh ha area. On the other hand, Western region had only 2.09 lakh ha area under pulse (Hasan and Khan,2018). From thetable it is observed that in state, overall variation in areaunder pulse crops was 2.32 percent. Across the zone, overall variation was highest 12.54 per cent in Vindhyan Zone followed by Western Plain Zone (11.30 per cent),Bundelkhand Zone (8.99 per cent), Mid Western PlainZone (6.62 per cent), Bhabhar and Tarai Zone (5.76 percent), South Western Semi Arid Zone (5.14 per cent),Eastern Plain Zone (3.29 per cent), Central Zone (2.97per cent) and in North Eastern Plain Zone (1.51 per cent)in order of merit. The variability in production table shows that in the state as a whole, overall variability was estimated to be 19.29 per cent. The overall variability in yield of pulse crops in the state was 18.19 per cent. The overall variability in yield across the zones was highest (24.28 per cent) in Vindhaya Zone followed by that in North Eastern Plain Zone (20.68 per cent), Central Zone (19.26 per cent), South Western Semi Arid Zone (18.75per cent), Eastern Plain Zone(17.90 per cent), Mid western Plain Zone (16.80 per cent), Bhabhar and Tarai Zone(15.60 per cent), Western Plain Zone (14.99 percent) and lowest in Bundelkhand Zone (14.17 per cent).. Compound annual growth rate of area under pulses was recorded high for Urad bean (3.9 per cent) followed by moong bean (2.83 per cent) and lentil (2.06 per cent) during the period of 1981-82 to 2011-12 in the state of Uttar Pradesh. However, compound annual growth rate of area under urad bean and moong bean was recorded high in Bundelkhand (8.43 per cent and 5.87 per cent respectively). Similarly, a higher growth rate in

area under moong bean was reported in South-Western Semi-Arid Zone and Western Plain Zone. The significant growth of area under pigeon pea was reported in Western Plain Zone (3.06 per cent). A significant growth of area under lentil crop was recorded in Central Zone followed by Eastern Plain Zone, Vindhya Zone and North-Eastern Plain Zone.

Growth of area under pulses in Uttar Pradesh is shown in Chart 1. The area under pulses in the state has shown negative growth during the period of 1994-95 to 1999-2000 and 2005-06 to 2009-10 and 2010-11 to 2014-15. There has been negative growth in area under chickpea and pigeonpea during pre and post-reform period in the state. However, there has been significant growth in area under urad bean and moong bean during 1994-95 to 1999-2000 and 2005-06 to 2009-10. However, these crops witnessed negative growth during 2010-11 to 2014-15.

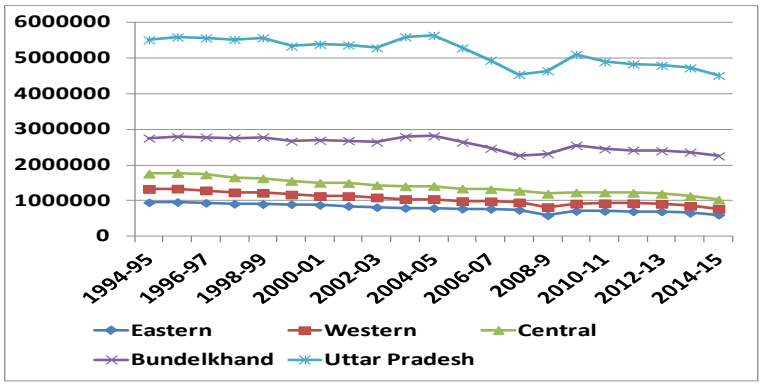
Chart 1: Growth of Area under Pulses in Uttar Pradesh (Area in 000 Hectares)



Source: Indian Institute of Pulses Research, Kanpur

Region-wise area under total pulses in Uttar Pradesh is shown in Chart 2. There has been negative growth in area under total pulses in all the geographical regions except Bundelkhand region during the period of 1994-95 to 1999-2000 and 2001-02 to 2004-05. Except for the period of 2000-2001 to 2004-05, area under total pulses in the state has fallen down significant in all the periods.

Chart 2: Region-wise Area under Total Pulses in Uttar Pradesh (Area in Hectares)



Source: Directorate of Agriculture, Government of Uttar Pradesh

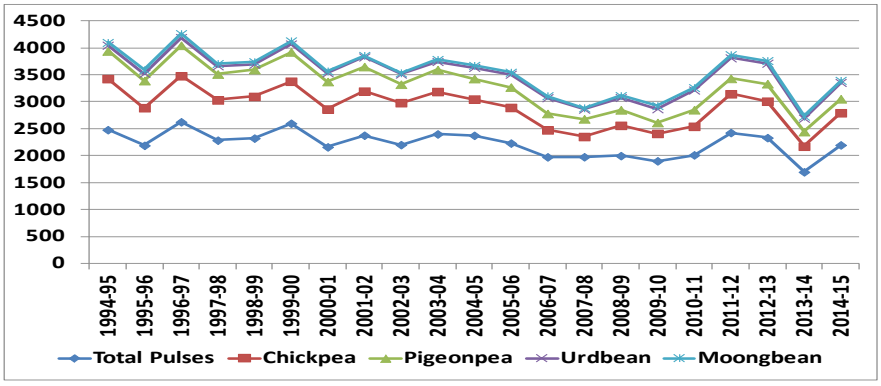
Out of total area under pulses in the state during 2014-15, area under urad bean accounted for more than 1/4th share while slightly less than 1/4th area was reported under chick pea. Eastern and Bundelkhand region have comparatively higher share in total area under pulses in the states. Region-wise composition of area under different pulses crops vary in the state. The Eastern region had a larger share under lentil crop and pigeon pea (tur) while more than 2/5th area under urad bean was reported in Western region. In Central region, area under urad bean was reported about 39 per cent while area under chick pea accounted for about 30 per cent in Bundelkhand. Area under urad bean and pea constituted more than half of the total area under pulses in the region. Bundelkhand accounted for more than half of share in area under pulses in the state during 2014-15 (54.32 per cent). The Eastern region had also significant share in total area under pulses during the year (26.88 per cent). Out of total area under pigeon pea, Eastern region accounted for 57.10 per cent while Bundelkhand had share of 20.35 per cent. Out of total area under chick pea in the state, more than 2/3rd area was reported in Bundelkhand (67.90 per cent). Bundelkhand and Eastern region accounted for 82 per cent share in area under lentil while more than 3/4th area in Bundelkhand was reported under pea. Similarly, the share of Bundelkhand in total area under urad bean was found highly significant (57.21 per cent). However, share of Central region was found significant in area under moong bean (22.06 per cent).

The area under pigeon pea crop has drastically fallen down in all the geographical regions as well as in the state during last two decades. However, there has been significant growth in area under pigeon pea crop in Bundelkhand during the period of 1994-95 to 2004-05 (20.28 per cent). There has been negative growth in area under pigeon pea crop during all the periods under study.There has been negative growth in area under chick pea in the state during the period of 1994-95 to 2014-15. However, area under chick pea in Bundelkhand has shown nominal growth of 0.001 per cent per annum during 2000-01 to 2004-05.

TRENDS IN PRODUCTION OF PULSES

Growth of production of pulses in Uttar Pradesh is shown in Chart 3. The production of pulses in the state has witnessed nominal growth during the period of 1994-95 to 1999-2000 and 2010-11 to 2014-15. However, production of total pulses was reported negative growth during 2000-01 to 2004-05 and 2005-06 to 2009-10. The negative growth in production of chickpea was reported during 1994-95 to 1999-2000, 2000-01 to 2005-06 to 2009-10. However, production of chickpea, pigeonpea and urad bean witnessed nominal growth during 2010-11 to 2014-15.

Chart 3: Growth of Production of Pulses in Uttar Pradesh (Production in 000 Metic Tones)



Source: Indian Institute of Pulses Research, Kanpur

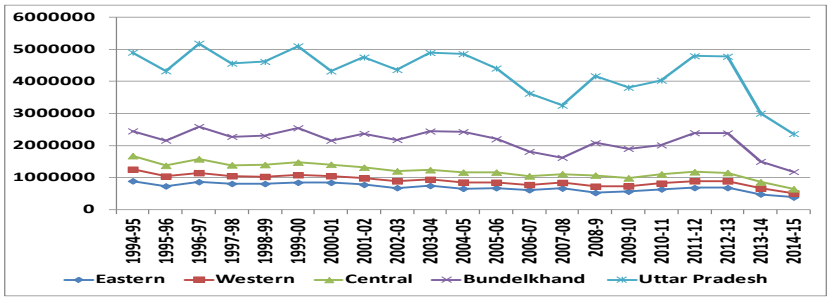
Bundelkhand and Eastern region accounted for 78.2 per cent in total production of pulses in the state during 2014-15. However, share of Western region and Central region was reported more than 60 per cent in total production of moong and about 1/3rd production of urad bean. More than 2/3rd production of pigeon pea was reported in Eastern region while about 60 per cent lentil of the state was produced in Eastern region. Bundelkhand accounted for 75 percent share in production of pea, 55 per cent share in urad bean and about half of the production of chick pea during 2014-15. Out of total production of pulses in the state, share of urad bean was reported 25.79 per cent and pea 25.26 per cent. There have been marked variations in composition of pulses crops in total production of pulses in all the geographical regions. Out of total production of pulses, about 2/5th production of pea was reported in Bundelkhand while about 44 per cent urad bean accounted in Western region against total production of pulses. In Eastern region, lentil and pigeon pea crops accounted for 58.52 per cent share against total production of pulses in the region.

There has been significant growth in production of urad bean (6.28 per cent per annum), moong bean (4.12 per cent per annum), pea (1.62 per cent per annum) and lentil (1.59 per cent per annum) during 1981-82 to 2011-12. However, there was negative growth in production of pigeon pea and chick pea in the state during the corresponding period. The compound annual growth rate was recorded high for pea followed by urad bean and moong bean in Bundelkhand during the period. Other regions which witnessed significant growth in production of urad bean and moong bean were reported Western Plain Zone, Mid-Western Plain Zone and Bhawar and Tarai Zone. The growth in production of lentil was found significant in Central zone, Vindhya zone and North-Eastern Plain Zone.

Region-wise production of total pulses in Uttar Pradesh is shown in Chart 4.There has been drastic decline in production of total pulses in the state in all the geographical regions in the state except Bundelkhand region during the period of 1994-95 to 2004-05. There was growth of 0.068 per cent per annum in production of total pulses in Bundelkhand during 1994-05 to 1999-2000 while production in the region grew by 0.033 per cent per annum

during the period of 2000-01 to 2004-05. The drastic decline in the production of pulses was due to low priority of pulses crops, crop failure, low productivity rate and other reasons.

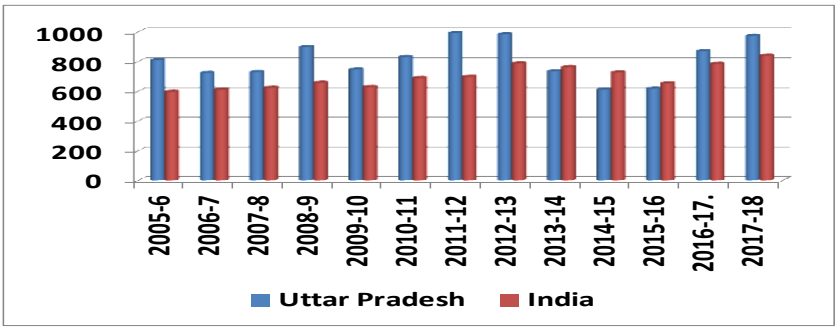
Chart 4: Region-wise Production of Total Pulses in Uttar Pradesh (Production in Metric Tons)



Source: Directorate of Agriculture, Government of Uttar Pradesh

Yield of total pulses in Uttar Pradesh and India is shown in Chart 5. Yield of total pulses in Uttar Pradesh and India was recorded higher than the national average. During 2017-18, there was 15.81 per cent higher yield of total pulses in U.P. as compared to national average of yield of total pulses. During 2005-06 to 2013-14, the yield of total pulses in U.P. was recorded higher in Uttar Pradesh as compared to national average. However, it has fallen down during 2014-15 to 2016-17.

Chart 5: Yield of Total Pulses in Uttar Pradesh and India (KG. / Hectare)

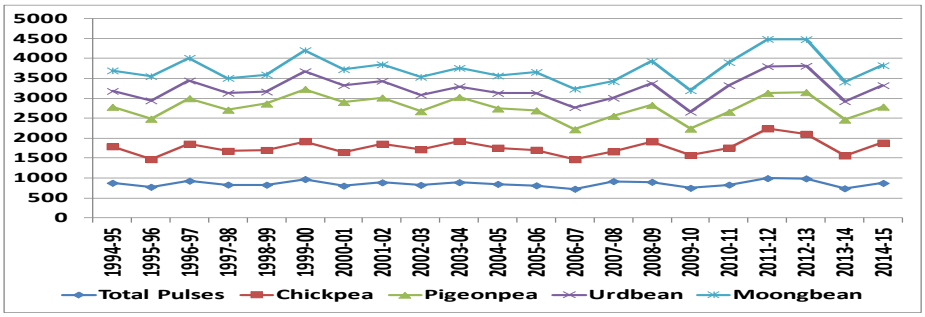


Source: Agricultural Statistics, India 2018

TRENDS IN PRODUCTIVITY OF PULSES

Growth of productivity under pulses in Uttar Pradesh is shown in Chart 6. As per information available from Indian Institute of Pulses Research, there has been significant increased productivity of pulses in the state during the period of 2010-11 to 2014-15. However, significant decline in productivity of mong bean was recorded in the state was recorded during the corresponding period. The productivity of chickpea and pigeon pea has also shown negative growth during the period of 2000-01 to 2004-05 and 2005-06 to 2009-10. However, productivity of urad bean was recorded 0.017 per cent per annum during 2005-06 to 2009-10 and 0.049 per cent during 2010-11 to 2014-15.

Chart 6: Growth of Productivity under Pulses in Uttar Pradesh (Yield in K. G/ Hectare)

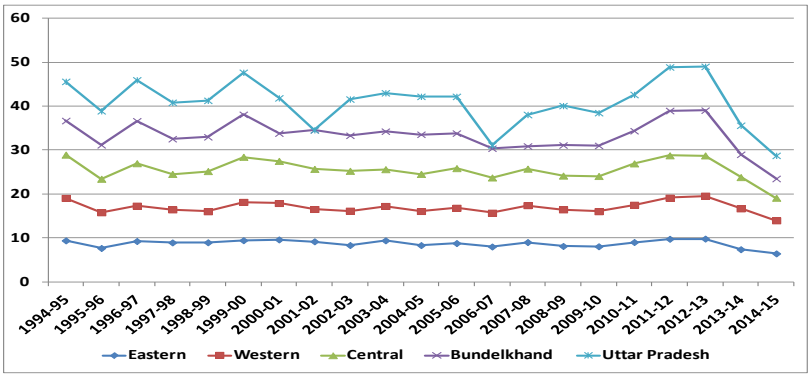


Source: Indian Institute of Pulses Research, Kanpur

The productivity of urad bean and moong bean has increased by 2.29 per cent per annum and 1.25 per cent per annum respectively in the state during the period of 1981-82 to 2011-12, However, the increase in productivity in urad bean was recorded significantly high in Bhawar and Tarai zone followed by Mid-Western Plain zone and North-Eastern Plain zone. Similarly, the increase in productivity of moong bean was recorded significant in Bundelkhand region followed by Mid-Western Plain zone and South-Western Semi-Arid zone. The increase in productivity of lentil was found highly significant in South-Western Semi-Arid zone, Bhawar and Tarai zone and North-Eastern Plain zone.

Region-wise productivity of total pulses in Uttar Pradesh is shown in Chart 7. The productivity of total pulses had comparatively higher annual growth in Bundelkhand as compared to other geographical regions during the period of 1994-05 to 1999-2000. However, productivity of total pulses recorded negative growth in all the regions during 2010-11 to 2014-15. However, productivity of total pulses in Eastern and Western zone recorded nominal growth during 2005-06 to 2009-10.

Chart 7: Region-wise Productivity of Total Pulses in Uttar Pradesh (Yield in Quintal/ Hectare)



The yield difference is defined as the difference between the maximum-attainable yield and the farm-level yield. There is empirical evidence about yield gap analysis of various food crops like rice, wheat; maize etc. (Jha, et al., 2011; Hall, et al., 2013 and Bhatia, et

al., 2006).In case of major crops of pulses such as chick pea, pigeon, lentil, etc., yield gap analysis is rare in the literature. However, some studies (Dwivedi, et al., 2013; Bhatia, et al., 2006 and Singh, et al., 2001) have tried to determine the yield differences of chickpeas and pigeons mostly in aggregate levels in India. The amount of rapid technological change and cultivation practices used to differentiate yields between the research station and the farmers' area, which is valuable to attract the attention of policymakers to develop and implement decisive planning and policies. The actual average yield of the farmers' farm was obtained from the Directorate of Agriculture, Government of Uttar Pradesh, while the potential yield of the crops was compiled from the annual reports of the Indian Institute of Pulses Research, Kanpur, India.

Rimal and Kumar (2015) compared the average yield of total pulses during 2007–2012 and classified eleven major pulses produced in two groups (yield / kg) higher than the national average and below the national average. The result shows that in most states the average yield of total pulses during 2007-2012 was more than the national average of 786 kg / ha whereas Rajasthan and Karnataka were the states with lower than national average. Although Rajasthan and Karnataka share in terms of area was higher than smaller states like Jharkhand, West Bengal, Bihar and Haryana, the average yield was comparatively lower. The results have shown the steady state of pulses crops in their respective major producing states and the potential of small pulses growing states in the development of pulses, as the yield of pulses crops in their small producing states was higher than the national average. Therefore policies suitable for minor pulses producing states will have long-term effects of pulses development and production stability. Comparison of total pulses yields across states and across India shows that major pulses such as Rajasthan and Karnataka had lower yields than the national average in production, while smaller states had higher yields. Thus, it indicates an immediate focus on smaller states to improve the production of pulses in the country. In the case of chick pea, Madhya Pradesh, the major pulses-producing state showed lower yields than the national average. Minor states are moving forward with a positive increase in the yield of individual pulses and have shown potential for increased production of pulses and such a situation should be maintained with appropriate policy intervention. To achieve this objective and to promote integrated nutrient management and plant protection provision included in the National Food Security Mission-Pulses (NFSM-Pulses), it is necessary for the farmer to spread effectively and rapidly and for accelerated pulses has been strengthened. The production schedule should be ensured on time with expansion and institutional support (Rimal and Kumar, 2015) The actual yield of major crops in the state was recorded much below than the potential yield of the pulse crops. The yield gaps of pulse crops vary across the geographical regions in the state.

CONSTRAINTS IN PRODUCTION OF PULSES

Some of the major constraints in the production of pulses include adverse weather conditions, abnormal soil conditions, agro-economic constraints, better input quality, availability of pests and diseases, technical and infrastructure constraints, blue-bull troubles and credit,

marketing and policy constraints (Singh et al., 2015). To increase yields in pulses, it is necessary to encourage genetically modified technologies. In pulses, breeding is limited due to the narrow genetic basis of the varieties and their high susceptibility to insect and disease attacks. There is an urgent need to broaden the genetic base by strengthening the pre-breeding of pulses and developing the main sets of germplasm (Subramaniam, 2016). Harness of hybrid potential through the development of CMS (cytoplasmic nuclear male sterility) based hybrids in pigeon peas. Genomic research to understand pests and disease resistance, selection of mapping and tagging with the help of genes and markers, gene pyramiding for stable resistance, development of transgenic in chickpeas and understanding the structure and function of genes (Ali and Gupta, 2012) .Singh at Al., (2015) have elaborated potential methods and techniques that ensure increased production without expanding crop area. The first in the vertical approach is gradual cropping and propagation of intercropping of pulses. Several intercropping systems for pulses have been developed by agricultural research stations. Farmers in rainfed states are familiar with these practices and have practiced them in traditional ways. The second approach in the vertical approach is the replacement or multiplication strategy. The major obstacle related to the promotion of quality seeds is the availability of better varieties of seeds in sufficient quantities at the appropriate time. The third replacement seed in the vertical approach is balanced nutrient management. Through various studies that sulfur application at the time of sowing and the application of zinc sulfate once every two years effectively address the problem of depletion of these compounds in pulses.It was also noted that the use of these compounds can maximize the efficient use of water as well as crop productivity. Mechanization in pulses follows the vertical approach. Mechanization of soil is very important to increase the productivity of crops. Adopting inter-culture operations with deep tillage, ridge planting, line sowing, mechanization contributes to the timeliness of operations, lower production costs and improve resource utilization efficiency (Singh et.al., 2014 and Patel et.al., 2014)).The 'Haldhar' scheme of Government of Madhya Pradesh has made provision of subsidy to farmers for deep plowing of their land (Anonymous, 2013 and Singh et al., 2013) to encourage farmers to ensure deep tillage of their land There may be initiative. The vertical approach is the expansion of irrigation services by the use of resource conservation technologies. The use of sprinkler irrigation for widely spread crops such as pigeon peas has also proved fruitful

Under the horizontal approach, Singh et.al., (2015) have suggested efficient use of rice fallow land and replacement of low-productivity crops with pulses. Rain water can be used for rabi crop establishment (Anonymous, 2013 and Singh et. .al., 2013).Jeswani and Baldev (1990) have reported that pulses have a unique property with Rhizobium that lives independently in soil. Rhizobium penetrates the root hairs of pulp crops and fixes atmospheric nitrogen. Artificial inoculation with an efficient Rhizobium culture and thus ensures maximum availability of symbiotic nitrogen to the crop. Riseobium growth increases yields Pulse crops are attacked by more than one disease and pests at a time which requires many disease resistant varieties of crops. Reddy (2009) has suggested that integrated pest management is necessary. Crop systems that include crop rotation or intercropping of non-

host and host crops, various agro-economic practices such as using solar energy before summer plowing are some of the effective components of kharif pulses integrated pest management post-harvest, whichever is important. Among the post-harvest operations, storage operations are responsible for the maximum loss.Farmers have to face many difficulties in pulses cultivation. The main hurdles are non-availability of HYV seeds, non-availability of fertilizers, plant safety chemicals at the time of sowing, low availability of production, lack of subsidy for inputs, seed rate, lack of knowledge about seeds, treatment, weeds etc. The dosage and method of managing fertilizer inputs (Kumar et al. 2009), has likewise been reported by Yadav et al. (2002).

The Bundelkhand region comes under rainfed crop areas with little or no modern yield enhancing input. It is well known that due to the soil and climatic conditions, pulses such as urad, moong, lentils etc. are grown wildly by this region. The low priority given to pulse crops may be related to the relatively low status of their crops, mostly found in the eastern region of Uttar Pradesh. This is due to the area submerged in vegetable production for immediate income. As a crop of secondary importance, in many of these systems, pulses do not attract much attention to the crop management of the farmer.In addition, these crops are adversely affected by many biological and abiotic stresses, which are largely responsible for instability and low yields. There has been a high level of risk in the production of pulses. About half of the area of pulses is presently rainy which falls under the Bundelkhand region. The area irrigated under pulses has virtually stabilized. The availability of sufficient soil moisture for crop growth depends on rainfall, water holding capacity and soil depth in rainfed areas. Another major problem is soil salinity and alkalinity. Both salinity and alkalinity are higher in the Indo-Gangetic plains in the semi-arid tropics and in irrigated areas, which is a cause for concern, as most pulses are susceptible to salinity and alkalinity (Sharma et al, 2014). Pigeon pea suffer heavy damage due to poor drainage, reduced plant standing due to stagnation in the rainy season, and increased incidence of Phytophthora blight disease, a variety of insect species affect pulses.

Cash is an important element for transferring small farmers from low input-low output to high input-high output agriculture. But credit penetration by these farmers is low due to low asset base and low risk carrying capacity. In addition, credit facility for pulses crops from formal and informal sources is limited due to unstable returns. Lack of quality seeds of pulses is one of the most significant barriers, followed by yellow mosaic disease in moong and uradbean, pod borer problem and weed infection problem in pulses cultivation. Lack of knowledge about quality seeds, lack of timely availability of seeds, lack of knowledge about Rhizobium used, lack of knowledge about used trichoderma, non-availability of rhizome crops, non-availability of fertilizers, wilt Problem, yellow mosaic problem, pod borer problem, poor effect of fungicide (96%), weed management problem. Lack of knowledge about the support price and problem of blue bulls are some of the reasons (Kumar et al., 2017)

Pulses are mainly grown under rainfed conditions except in few districts of Karnataka, Uttar Pradesh, Madhya Pradesh, Rajasthan and Bihar As a consequence, area under pulses

and their productivity are dependent on amount and distribution of rainfall. Rainfall intensity and distribution leads to vulnerability of kharif pulses to water stagnation and that of rabi pulses to water stress. Occurrence of mid-season cold waves and terminal heat during winter season has also been causing losses to crop productivity of rabi pulses in many regions. Pulses crops are generally very sensitive to acidic, saline and alkaline soil conditions. Nutrient requirement of pulses is much lower than cereals .Timely availability of quality chemical fertilizers continues to be problem in many pulses growing area. Inadequate availability of gypsum or pyrites as a cheap source of sulphur remains a serious impediment in many regions. Pulses are grown under varied agro-climatic conditions (Govt. of India,2009) This is calls for region specific production technology including crop varieties with traits relevant to prevailing biotic and abiotic stresses. Even biological fertilizers and pesticides used should be based on strains isolated from regions with similar agro-climatic conditions for them to be effective. Farmers also lack awareness and means for safe storage of grain/ seed of pulses. Many areas are approachable only during fair weather. Warehousing facilities are either inadequate or inaccessible.

CONCLUSION

The state of Uttar Pradesh has prominent share in pulses production of India. The Eastern Region and Bundelkhand have major share in area and production of pulses crops in the state. The Pigeonpea, Chickpea, Pea, Lentil, Moongbean, and Urdbean are the major pulses croprs in the state. Though pulses are mainly grown in rainfed areas, however, Urdbean and Moongbean crops are also grown in irrigated areas mainly in Central and Western regions of the state. There has been fluctuating trend in growth of area, production and yield of pulses crops.. The declining trends were reported over the period of last twenty years. , however, with the implementation of National food security Mission and coverage of all districts under Mission for pulses production is expected to change significantly the scenario of pulses production in the state.

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