International Journal of Agricultural Sciences
Volume 13 | Issue 1 | January, 2017 | 132-137 ■ e ISSN-0976-5670
DOI:10.15740/HAS/IJAS/13.1/132-137
Visit us : *www.researchjournal.co.in*

A REVIEW

Production enhancement prospects in pulses of Bihar

VIVEK DUBEY*, MD. SAQUIB ALAM AND DEVENDRA SINGH
Department of Agronomy, Tirhut College of Agriculture, Dr. Rajendra Prasad Central Agricultural University, Pusa, SAMASTIPUR (BIHAR) INDIA
(Email : vivekdubey012345@gmail.com; 28saquib@gmail.com ; dsfraupusa@gmail.com)

Abstract : Bihar has always played its role to meet the goals of National Food Security since time immemorial. A major emphasis was laid towards production of cereals, oilseeds, cash crops, etc. Unfortunately it lagged in pulse production although the geo-topographical situation is favourable for almost all pulses grown in the country. This article provides the reasons for such constraint and possible remedies and solution based on current scenario prevailing in the state.

Key Words : Constraint, Management, Productivity, Pulses

View Point Article : Dubey, Vivek, Alam, Md. Saquib and Singh, Devendra (2017). Production enhancement prospects in pulses of Bihar. *Internat. J. agric. Sci.*, **13** (1) : 132-137, **DOI:10.15740/HAS/IJAS/13.1/132-137.**

Article History : Received : 13.10.2016**; Accepted :** 24.12.2016

INTRODUCTION

Pulses are an important source of protein, high fibre content and provide ample quantity of vitamins and minerals. Keeping in view large benefits of pulses for human health, the United Nations has proclaimed 2016 as the International Year of Pulses. Thus, due attention is required to enhance the production of pulses not only to meet the dietary requirement of protein but also to raise the awareness about pulses for achieving nutritional, food security and environmental sustainability. Pulses are important component to sustain the agriculture production as the pulse crops possess wide adaptability to fit into various cropping systems, improve the soil fertility being leguminous in nature and physical health of soil while making soil more productive and sustainable in yield.

Status of pulse production :

Globally, pulses are grown in more than 171 countries. The pulse crops occupied 72.3 million ha area and contributed 64.4 million tons with productivity of 890 kg/ha in the triennium ending 2010-11. The highest productivity was of France (4219 kg / ha) followed by Canada (1936); USA (1882); Russian Federation (1643) and China (1596).

India having the largest shares about 25 per cent production, about 33 per cent acreage and about 27 per cent consuming of total pulses of the world. The acreage ranged from 20.35 (2000-01) to 23.99 million ha (2012-13) and production varied from 11.08 (2000-01) to 18.45 million tons (2012-13). The productivity has increased from 544 kg/ha (2000-01) to 750 kg/ha (2012-13).

When we concentrate particularly on the scenario of Bihar, we find a gradual decrease in area from 6.1 to 3.8 lakh ha from 2006-07 to 2012-13 but the production did not dropped significantly as it was 4.51MT initially and 4.4 MT finally but the constraint is growing population

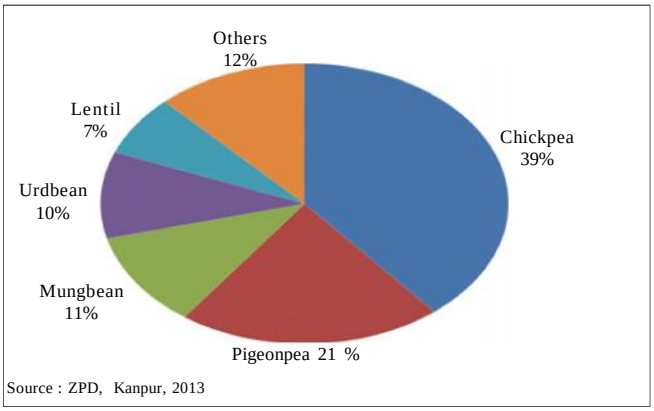
*** Author for correspondence:**

that requires more than it was before (data from Govt. of Bihar).

State	Production (MT)	Production (%)
Uttar Pradesh	3.196	21.8
Madhya Pradesh	2.859	19.5
Rajasthan	1.994	13.6
Maharashtra	1.407	9.6
Orissa	1.202	8.2
Bihar	1.041	7.1
Karnataka	0.777	5.3
Haryana	0.748	5.1
Other states	1.437	9.8
Total	14.66	100

Source: Department of Agriculture and Co-operation, Ministry of Agriculture, Govt. of India

Scenario of pulses			
Total pulses	Area (M ha)	Production (MT)	Productivity (kg/ ha)
World*	72.30	64.40	890
India	25.21	16.78	785
Bihar	0.38	0.44	1152



Source : ZPD, Kanpur, 2013

Fig. 1 : Contribution of various pulses towards total pulse production in India

Requirements of India		
Year	Population (million)	Requirement (MT)
Present	1330	24.60
2020	1389	25.69
2030	1680	31.07

*Current deficit : 7.82 MT

Demand- supply scenario of pulses in country :

–With the current deficit of 7.82 MT an additional area of about 10 million ha will be required to bring under pulses, to meet the current deficit.

–But with the shrinking area under these crops due to various reasons, achieving this target is not possible.

–The gap can be reduced to some extent by enhancing the productivity of Pulses through various measures.

Geo-topographical situation :

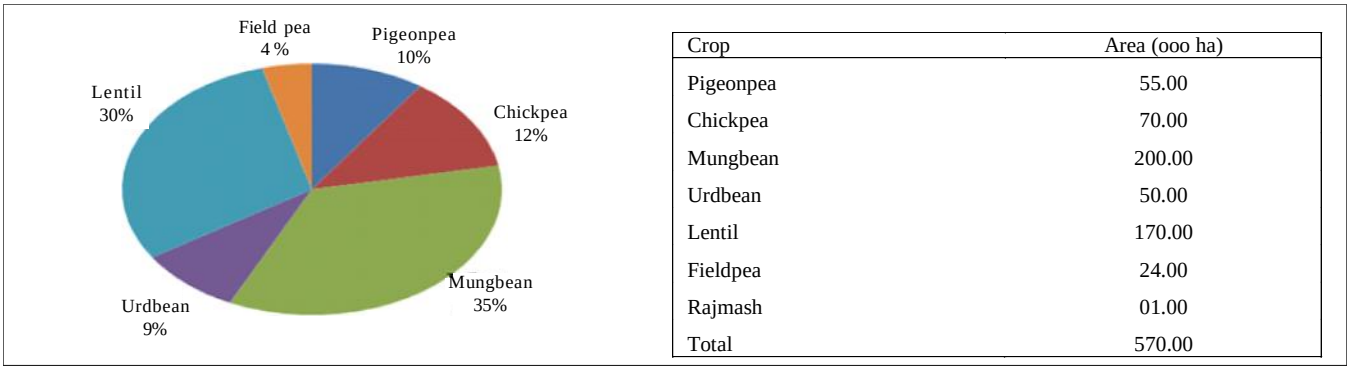
–Bihar has a unique feature of agro-climatic conditions suited for growing a wide variety of pulses in different seasons and regions as illustrated:

Sr. No.	Crop season	Pulse crops
1.	*Rabi* (Winter)	Chickpea, lentil, peas, lathyrus, fababean, rajmash
2.	Summer	Mungbean, urdbean, cowpea
3.	*Kharif*	Pigeonpea, urdbean, horse gram, cowpea and mungbean
4.	Pre-*Rabi*	Pigeonpea
5.	Spring	Mungbean and urdbean

–The diara areas around river ganga has around 75-85 per cent clay which is a rich source of organic matter that could enhance productivity manifolds.

Pulse production : A great challenge :

In Bihar, people are mostly vegetarian in dietary



Crop	Area (ooo ha)
Pigeonpea	55.00
Chickpea	70.00
Mungbean	200.00
Urdbean	50.00
Lentil	170.00
Fieldpea	24.00
Rajmash	01.00
Total	570.00

Fig. 2 : Present scenario of pulses in Bihar

habits and depend largely on pulses as the source of dietary protein. But production of pulses has not kept pace with the population growth and per capita availability of pulses has thus, declined from 64 g/day in 1950-51 to less than 19.0 g/day in 2012 as against 70 g/day the standards prescribed by ICMR. This alarming situation perhaps has arisen largely due to the quest for food security rather than nutritional security, being the prime national agenda. In total food basket, less than 5.0 per cent is shared by pulses. Due to the mismatch of supply and demand of pulses (*i.e.* shortage of supply of pulses), the prices of pulses increased exorbitantly over the years and have gone beyond the reach of common mass in the area. To meet the high demand for pulses, the global market for essential source of protein for the vegetarian population in the country is a matter of serious concern in national perspective. Inappropriate procurement policy, price fluctuation in market as per produce and lack of highly equipped machinery is also a great concern. The requirement of pulses will continue to increase in future mainly due to ever increasing population and preference for pulses as the cheapest source of dietary protein. Enhancing pulses production, is thus essentially required to make the country self-sufficient.

Constraints in pulse production in Bihar :

- Inadequate supply of quality seeds of improved varieties and poor varietal / seed replacement rate is an important constraint.
- There are few varieties for biotic, abiotic stresses and agro-ecological suitability that can be cultivated in different zones of Eastern India.
- Inadequate supply and poor adoption of quality bio-fertilizers with efficient strains of *Rhizobium* and PSB.
- Reduction in soil organic carbon due to intensive cereal-cereal cropping system.
- Improper adoption of IPM and INM pest epidemics.
- Labour intensive operation *viz.*, harvesting and threshing of crops like red gram, mung bean and urd bean.
- Disruption of drainage system leading to water logging throughout the state.
- Poor water management techniques (flood irrigation reduced total yield).
- Changes to cropping pattern (*i.e.* use of long duration varieties of rice).
- Poor adoption and inefficient technologies developed for Tal land, Diara land and Chaur / Dhab area.
- Lack of land reforms and consolidation.
- Standardization and revalidation of improved package for Paira and Utera cropping.
- Poor adoption due to slow awareness of developed technologies.
- Poor availability of micro nutrient *viz.*, Zn, B, S, Mo due to continuous application of only recommended doses of NPK.
- Lack of mechanization (sowing to harvesting).
- Fluctuating prices of pulses and procurement on MSP.

Remedies and solutions :

Most of the constraints are very much associated with agronomic management like continuous cultivation of cereal crops reduced the soil health *i.e.* deficiencies in organic carbon, macro and micro nutrient resultant reduction in yield of pulse crops and non pod setting in pulses like pigeonpea and chickpea. Therefore, using scientific arrangement in pulse crops under different cropping system will certainly improve the total productivity of cropping system ultimately productivity of pulse crop. For example :

– Rice	Chickpea + linseed	Green manuring
– Maize (Early)	Pre- *Rabi*/arhar	September sown
– Rice	Lentil	Mungbean
– Urdbean	Maize+Rajmash	Green manuring
– Arhar + urdbean/ Mungbean/Sesame/ Maize inter cropping		
– Rice	Maize+ lentil	Sesame
– Green manuring	Lentil+coriander	Mungbean

This type of scientific arrangement of cropping system has large scope for enhancing pulse productivity / production in sustainable manner. Reduction in soil organic carbon is a threat of imbalance availability of nutrients to the plant, water holding capacity of soil, poor soil physical environment, less microbial activities, ultimately affects the productivity of pulse crop. Thus, it can only be corrected with better agronomic management of cropping system.

Organic carbon status is directly responsible for availability of micro nutrients and soil pH. Deficiency of micro nutrients like Zn, B, Mo, Fe, Mn, etc. reduce the yield of pulse crop even upto very high extent, sometimes hundred per cent. So, the deficiencies of micro nutrient can be managed by using balance fertilization, soil

amendments, green manuring, composting etc.

Seed is the prime factor for improving productivity of pulse crop. Non-availability of good quality seed of recommended varieties of pulses is the major constraints of Bihar for poor pulse production. Before sowing the crop you must arrange quality seed. The seed treatments help in maintaining plant population and reducing incidence of pest and diseases during crop growth and ultimately help in enhancing the pulse productivity. In case of pulses FIR (Fungicide + Insecticide + *Rhizobium*) system of seed treatment is recommended.

Phosphorus solubilising bacteria is a very effective bio fertilizer which enhances the availability of phosphorus to the plant should be used before sowing of the entire pulse crop.

Sowing methods and crop geometry are the tools, which are effective to enhance productivity of crops. Conventional system of sowing of pulse crop is expensive than the no tillage method but, the constraint of no tillage method (Para method) is poor plant population and ultimate poor yield. After invention of Zero till drill machine the sowing of pulse like lentil, pea, chickpea become easier in rice fallow field even after combine harvesting. It has found proven the higher crop yield of lentil and chickpea are in zero tillage sowing field than conventional and paira cropping. Several farmers are growing the crop through this method. It should be popularised.

In case of pigeonpea, maintain wider row spacing with double row planting with closer spacing (30 cm apart) proven good for inter cropping with maize, sesame, urd and turmeric. This system is also suitable for micro irrigation which may be tried for enhancing productivity of arhar.

Irrigation and drainage :

Drainage is a major factor which affects the yield of pulse. All the *Kharif* pulses should sow with full drainage system. Water logging can badly affect the plant population and growth of the pulse crop.

Being drought tolerance behaviour of most of the pulse crops are growing in rain fed conditions and mostly un-irrigated cause's poor yield. Long duration pigeonpea is grown in eastern part of India. Generally it is grown in rainfed condition and not a single irrigation provided for this crop. Less flowering and flower dropping occurs due to moisture stress at the time. Even pod setting and their development are also affected badly due to moisture stress. Two to three light irrigation at critical stages, at gap, before flowering and after pod formation under moisture stress condition are very beneficial for improvement of overall productivity of Arhar. More work on use of drip irrigation or micro sprinkler is required with pigeonpea, chickpea, lentil and fieldpea.

In case of lentil and chickpea, which are generally grown in heavy soil like Tal and Diara land and higher clay content soil like sone command area. Due to high clay content swelling and shrinkage behaviour of the soil cause, severe damage to the plant and wilting of plant take place when applied flood irrigation. Other hand moisture stress causes low vegetative growth and pod formation. This complicated situation can only manage with providing one irrigation through sprinkler before flowering during long drought spell.

In summer/spring crop like mung bean and urd bean requirement of 2, 3, light irrigation is must. Again irrigation through sprinkler is superior over flood irrigation. More work needed for authentication of micro – irrigation for enhancing pulse production. The pulse scientist may take initiative for conducting trials and front line demonstration on use of micro – irrigation in pulse crop. Making provision of irrigation facilities for mere 5.0 lakh hectares through floating SPV pumping system with micro irrigation system can :

–Double the income of the benefited farmers.

–Produce a minimum of 5 lakh tonnes of pulses every year.

–Produce green fodder to the tune of 20 lakh tonnes, every year.

Nutrient management :

Balance use of nutrients in adequate amount and available farm holds the key of successful crop production. Adding right amount of nutrients at right time through an appropriate method, making efficient nutrient use for enhancing pulse productivity and maintaining soil fertility. Pulse require less amount of nitrogen as they are capable of fixing atmospheric N. Biologically through *Rhizobium* bacteria but need adequate phosphorus and sulphur for their root development and synthesis of sulphur containing amino acids. Pulses also require comparatively higher amount of micro nutrients like boron, molybdenum, iron which are integral constituents of nitrogenase enzyme, essentially required for nitrogen fixation. In principal before applying the nutrients, status of soil nutrients must be known. In a flat

recommendation 20 kg N + 40 – 45 kg P_2O_5 + 20 kg K_2O and 20 kg sulphur along with 5 kg zink is recommended for good harvest of chickpea, pigeonpea, lentil and pea. But, without knowing the nutrient status of soil you could not gotten targeted yield due to many reasons. Un-availability of some micro nutrient like boron, molybdenum and iron reduce the grain yield in a big amount.

Weed management :

Yield losses due to weed in pulse crop is varied from 20-90 per cent. Critical period of crop weed competition varies crop to crop. In case of chickpea, lentil, pea and rajmash, it was observed at upto 30 to 50 days from date of sowing. However, it varies from 30 to 70 days in long duration pigeonpea and upto 35-40 days from date of sowing in case of mung and urd crop. Integrated weed management is only solution for checking yield losses due to weeds. No doubt manual weeding at early stages is most effective for managing weed but it become so expensive due to higher labour wages and their poor working efficiency. It is also difficult due to paucity of labourer in time. Mechanical weeding is another effective way for managing weed but it is not applicable in broad casted field. Recent advances in chemical weed control got very popular among the farmer but it is very sensitive and hazardous to the crops when applied without knowing the write recommendation for cropping system. Some times its residual effect badly harms to follow up crop. For example use of atrazine in *Kharif* maize can suppress the germination and growth of lentil in succeeding crop. Similar in case of use of atrazine in maize + potato inter cropping will affect the tuberization of potato without showing any phyto-toxic symptoms on the leaves of potato.

Recommendation :

– Application of pendimethalin @1.0 kg/ha as pre-emergence followed by one harrowing or manual weeding is effective to control weed in the field of chickpea, lentil, pigeonpea and rajmash.

– Post-emergence application of imazethapyr @ 50-75 g/ha is effective for controlling most of the grassy weed in the field of pigeonpea, mung bean and urd bean. Application of metribuzine @ 250 g/ha as pre-emergence is effective to control weed in the field of pea.

– Some useful devices like hand hoe, wheel hoe, power weeder are very economical and effective to control weed in line sown of pulses.

Plant protection :

Pulses are susceptible to many insect-pests and diseases. The losses in yield due to lack of plant protection measures vary from 46-96 per cent depending on the crop and varieties.

Integrated pest management (IPM) in pulses refers to application of an inter -connected set of principle and methods to minimize problems caused by insects, diseases, weeds and other agricultural pests. IPM includes use of resistant or tolerant varieties, crop rotation with non-host crops etc. Intercropping of gram + linseed/mustard or gram + coriander encourages natural enemies of pod borers. Use of bio insecticide NPV @ 250-500 LE/ha controls pod borers. Use of neem seed kernel extract (5%) is also helpful for control of pod borers. Use of sex pheromone trap is also helpful in controlling pod borers. Ahmad *et al.* (1999) reported that appropriate IPM module for control of gram pod borer NPV @ 250 LE/ ha followed by cypermethrin 0.02 per cent at 10 days interval was effective and recorded higher grain yield as compared to NPV @ 250 LE/ha alone. Pheromone based fruit fly management is another viable option for fruit fly management in beans and other vegetables (Sood *et al*., 2013).

IPM includes deep summer ploughing and field sanitation, growing resistant varieties, seed treatment with fungicides, crop rotations with sorghum and tobacco,

Sr.No.	Action	Yield gain
1.	Replacement of seed of 10% area, yield enhancement @ 20%	8.00
2.	Use of micro-irrigation for pulses in 10% area, yield enhancement @ 15%	5.00
3.	Intercropping with Maize in 20% area	15.00
4.	Cultivation of Pulses (short duration) in Tal, Diara, Dhab, Chaur lands during summer utilizing residual moisture in 3 lakh ha, with micro-irrigation through solar power.	135.00
5.	Use of other scientific agronomical management may further increase the yield over conventional @ 10%	40.00
	Total	203.00

Figures above gives a picture of the scope available inland to boost the production

soil solarisation and soil treatment with formaldehyde, captan and vapam etc., application of neem cake @ 150 kg/ha basically to reduce root-rot. AM fungi also induce disease tolerance in legume crops (Kumar *et al.* 2014). Various fungicides and bio-agents are tried as seed treatment to control pulse diseases. Application of carbendazim + thiram and bio-agent *(Trichoderma viride)* in combination with vitavax are best for reducing wilt incidence in pulses.

Criticals :

If we are able to walk on this road map following factors will increase the total pulse production ('000 t)

Conclusion :

The stagnation in pulses sector is a result of intermittent attention in the literature but hardly any action is taken up on policy front. Yield variability of pulses in un-irrigated regions, pest and insect problems and non-availability of quality seeds are the major factors that force farmers to shift away from pulses cultivation. Econometric analysis shows that providing assured price support policies through proper changes in procurement policy of government is a good option in short run; improvement of irrigation facilities, marketing facilities including procurement by NAFED and extension for addressing pest problems and weed eradication are needed in medium term to improve the pulse production scenario in the state.; but in the long run , development and dissemination of improved technology is very essential.

The contribution of area to production growth has been minimal so far. Therefore, efforts should be made to increase area under pulses through bringing some of diara land under its cultivation and rainfed rice fallow lands. Lastly, the statistical system needs a great deal of improvement in order to strengthen the research efforts.

REFERENCES

Ahmad, R., Yadava, C.P. and Lal, S.S. (1999). Efficacy of nuclearpolyhedrosis virus for the management of *Helicoverpa armigera* infesting chickpea. *Indian J. Pulses Res.*, **12** (1): 92–96.

Kumar, A., Suri, V.K. and Choudhary, A.K. (2014). Influence ofinorganic phosphorus, VAM fungi and irrigation regimes oncrop productivity and phosphorus transformations in okra (*Abelmoschus esculentus* L.)–pea (*Pisum sativum* L.) cropping system in an acid Alfisol. Commun. *Soil Sci. & Plant Anal.*, **45** (7): 953–967.

National conference on bringing self sufficiency in pulses for Eastern India organized by Bihar Agricultural University, Sabour, Bhagalpur in collaboration with ISPRD, IIPR, Kanpur between 05-06 August, 2016 at Bihar Agricultural University, Bhagalpur.

Singh, A.K., Singh,S.S., Prakash, Ved, Santosh and Dwivedi, S.K.(2015). Pulses production in India: Present status, bottleneck and way forward, *J. Agric. Search*, **2**(2): 75-83 ISSN : 2348-8808 (Print), 2348-8867.

Sood, P., Yadav, D.S., Thakur, S.K., Choudhary, A.K., Rahi, S. and Chauhan, K. (2013). Pheromone based fruit fly management forsustainability – A case study. (In) Proceedings of National Seminar on Indian Agriculture: Present Situation, Challenges,Remedies and Road Map, held at CSK HPKV, Palampurduring 4-5 Aug. 2012, CSK HPKV Publication, pp. 25–8.