Production and Technological Gaps in Middle Indo-Gangetic Plains

ICAR Research Complex for Eastern Region
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Policy Document

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Production and Technological Gaps in Middle Indo-Gangetic Plains

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FOREWORD

The Middle Indo-Gangetic Plains (MIGP) covering eastern Uttar Pradesh and Bihar is characterized by rich natural resources but poor productivity and low income. The region has favourable climate and an abundant supply of water, however, frequent occurrence of flood; water logging and even drought or drought like situation adversely affects the agricultural productivity and livelihood security. The small and scattered land holdings, less ground water utilization, poor mechanization, unavailability of quality seeds and planting material, imbalance use of fertilizer, deterioration of soil health, problem of heavy metals like arsenic in water, lack of stress-tolerant crop varieties, crop damage by wild animals, poor extension mechanism and marketing of the agricultural products are some of the major bottlenecks to improve upon the productivity and thereby profitability of the farmers. Nevertheless, the region has great potential for crop production, besides livestock and fishery development.

In order to critically analyze the production and technological gaps in the country, agro-climatic region wise workshops have been organized by ICAR in reference to the PMO ID No. 100/29/C/1/2015-ES.2 dated 11-08-2015. For identifying the production and technological gaps in MIGP, covering the states of Bihar and Eastern UP, the Workshop was organized at the ICAR-Research Complex for Eastern Region, Patna on 7th October, 2015 wherein 80 participents provided their inputs.

I would like to express my sincere gratitude to Dr. Gopalji Trivedi, Ex-Vice Chancellor, RAU, Pusa, Directors of various ICAR institutes, SAUs, officers from CG Centres, KVKs, NGOs, State Government officials and farmers of the region for their participation and deliberations. Dr. B.P. Bhatt, Director, ICAR-RCER, Patna and his team deserves special thanks for successfully organizing the workshop and bringing out this document for agricultural development in the Middle Indo-Gangetic Plains.

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Indo-Gangetic Plains of India

The Indo-Gangetic Plains (IGP) in India mainly comprises of five states *viz.*, Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal. As per the Planning Commission's agro-climatic zones, the IGP in India is divided into four major sub regions (Fig 1.)

- Trans-Gangetic Plains (TGP): Punjab, Haryana, Chandigarh and Delhi in the northwestern plains.
- Upper-Gangetic Plains (UGP): Western and Central Uttar Pradesh
- Middle-Gangetic Plains (MGP): Eastern Uttar Pradesh and Bihar
- Lower-Gangetic Plains (LGP): West Bengal

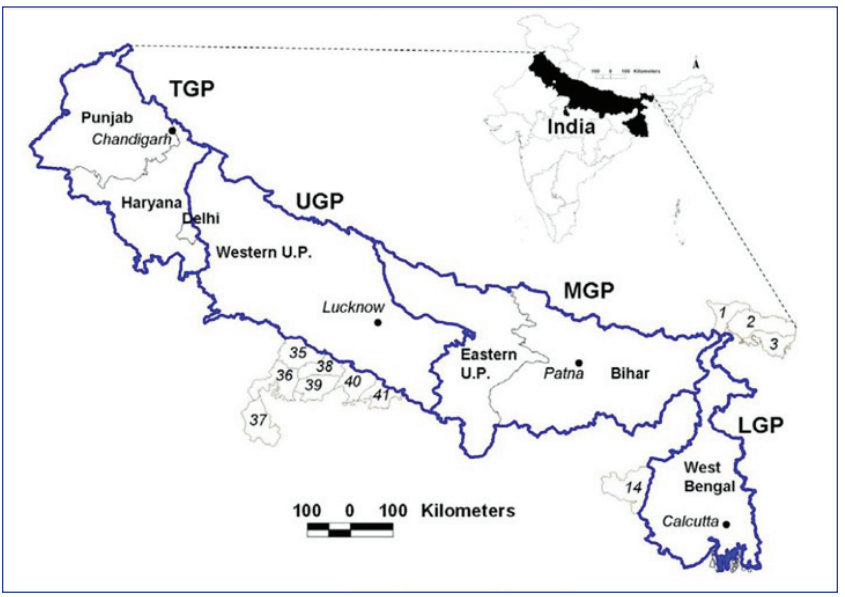

Fig. 1. Indo-Gangetic Plains (IGP) in India

The Middle IGP at a Glance

The Middle IGP (Eastern UP and Bihar) has a total geographical area of 18.07 m ha and population of 183.54 million (2011 census) with a population density of 1075 persons/km^2. The region is generally characterized by fertile soils, favourable climate and an abundant supply of water. Soils of the Middle IGP are deep (150.75 cm), silt loam (sand 31.05%, silt 41.46%, clay 27.93%) and low in organic carbon content (0.26%).The average annual rainfall is 1193 mm with rainy season from June to September. Marginal farmers accounts for 88% in the region as against 67% of the national average (Table 1). The operational land holding size in the region is very small and fragmented. The size decreased from 0.58 ha in 2000-01 to 0.39 ha in 2010-11 in Bihar and 0.65 ha to 0.60 ha in eastern UP due to increase in number of land holders (Table 2). The region has the maximum human population (39.3%) living below poverty line as against 30.3% in LGP, 27.7% in UGP and only 8.3% in TGP. Fragmentation of land is a major constraint in Middle IGP. Hence, Land Ceiling Act must be reviewed to allow migration within the categories below middle level for viable agriculture. Marginal and small farmers in these regions can be encouraged to grow vegetables for absorbing them in employment generation. Utilization of water resource remains poor as indicated by the poor water use efficiency (40-60%) observed across all major and medium irrigation projects.

Table 1. Operational holdings (%) by major size group

States	Marginal	Small	Semi-medium	Medium	Large
	< 1 ha	1-2 ha	2-4 ha	4-10 ha	> 10 ha
Bihar	91.06	5.86	2.56	0.50	0.02
Eastern UP*	84.95	10.14	3.92	0.91	0.07
Eastern Region	81.24	11.92	5.26	1.43	0.15
India	67.04	17.93	10.05	4.25	0.73

Table 2. Number (m nos.) and area (ha) of operational land holdings

States	2000-01		2010-11	
	Nos.	Holding Size (ha)	Nos.	Holding Size (ha)
Bihar	11.57	0.58	16.19	0.39
Eastern UP*	9.50	0.65	10.03	0.60
India	119.93	1.35	120.43	1.18

The major crops grown are rice, wheat, maize, chickpea, lentil, mustard, potato, sugarcane and vegetables. But the productivity of major crops of the region is lower than that of the national average (Tables 4-8), suggesting scope for technological interventions and disseminations in the region. The productivity of vegetables and fruit crops in the region is however, higher than the national average (Tables 9&10), indicating the great potential of these crops in the region. The major areas of the region are occupied by rice-wheat cropping system. The fertilizer consumption in middle IGP is very high and it varies from 148.86 kg/ha in eastern UP to 164.87 kg/ha in Bihar as against the national average of 125.39 kg NPK/ha (Table 11). But the proportion of nitrogenous fertilizer (urea) use is very high as compared to phosphorus and potash, leading to imbalance nutrient use and deficiency of micro-nutrients in soil-plant system. The net annual ground water availability in the region is 52.33 BCM and the annual ground water draft is 29.63 BCM (Table 12). The food grain productivity of MIGP (2.16 t/ha) is slightly higher than that of national average (2.10 t/ha) (Table 13).

Table 3. Districts under Food Security Mission

States	Total no. of districts	Rice	Wheat	Pulses
Bihar	38	15	10	38
Eastern U.P.	27	13	22	27
Eastern region	190	78	32	173
All India	671	199	119	557

Table 4. Area, production and productivity of rice

Region	Area (m ha)	Production (m tonnes)	Productivity (t/ha)
Lower Gangetic Plains	7.77	20.09	2.44
Middle Gangetic Plains	6.55	13.40	2.03
Eastern Plateau & Hills	9.20	17.04	1.94
India	43.95	106.54	2.42

Table 5. Area, production and productivity of wheat

Region	Area (m ha)	Production (m tonnes)	Productivity (t/ha)
Lower Gangetic Plains	0.38	0.98	1.81
Middle Gangetic Plains	5.91	15.03	2.52
Eastern Plateau & Hills	0.27	0.49	1.65
India	31.19	95.91	3.08

Table 6. Area, production and productivity of maize

Region	Area (m ha)	Production (m tonnes)	Productivity (t/ha)
Lower Gangetic Plains	0.15	0.60	3.63
Middle Gangetic Plains	1.01	2.39	2.06
Eastern Plateau & Hills	0.48	1.03	2.29
India	9.43	24.35	2.58

Table 7. Area, production and productivity of pulses

Region	Area (m ha)	Production (m tonnes)	Productivity (t/ha)
Lower Gangetic Plains	0.40	0.33	0.76
Middle Gangetic Plains	1.12	1.09	0.97
Eastern Plateau & Hills	2.17	1.46	0.71
India	25.23	19.27	0.76

Table 8. Area, production and productivity of oilseeds

Region	Area (m ha)	Production (m tonnes)	Productivity (t/ha)
Lower Gangetic Plains	1.07	1.09	0.88
Middle Gangetic Plains	0.26	0.24	0.95
Eastern Plateau & Hills	0.79	0.54	0.70
India	28.53	32.88	1.15

Table 9. Area, production and productivity of vegetables

Region	Area (m ha)	Production (m tonnes)	Productivity (t/ha)
Lower Gangetic Plains	1.66	26.07	13.74
Middle Gangetic Plains	1.13	21.96	20.11
Eastern Plateau & Hills	1.39	19.14	13.66
India	9.40	162.90	17.34

Table 10. Area, production and productivity of fruits

Region	Area (m ha)	Production (m tonnes)	Productivity (t/ha)
Lower Gangetic Plains	0.37	4.92	13.45
Middle Gangetic Plains	0.44	6.56	15.73
Eastern Plateau & Hills	0.63	4.97	8.38
India	7.22	88.98	12.33

Table 11. Fertilizer consumption (kg/ha)

State	N	P_2O_5	K_2O	Total NPK
Bihar	124.88	27.44	12.55	164.87
Eastern UP*	115.18	29.63	4.06	148.86
Eastern Region (Average)	77.46	25.23	12.50	113.02
All India	85.79	28.85	10.75	125.39

Table 12. Ground water utilization (BCM)

States	Annual Replenishable GW	Net annual GW availability	Annual GW draft	Stage of GW develop-ment (%)	GW availability for future irrigation
Bihar	29.34	26.86	11.95	44	14.10
Eastern UP	27.29	25.47	17.68	69	7.58
Eastern Region	150.91	138.78	54.45	39	81.97
India	432.72	398.16	245.05	62	154.71

Table 13. Area, production and productivity of food grains

Region	Area (m ha)	Production (m tonnes)	Productivity (t/ha)
Lower Gangetic Plains	8.77	21.99	2.34
Middle Gangetic Plains	14.75	31.67	2.16
Eastern Plateau & Hills	12.34	20.1	1.67
India	126.04	264.77	2.10

The average water productivity is 0.54 kg/m^3. The electricity consumption in the agriculture sector in the region is also very low (5.63% in Bihar and 20.48% in eastern UP) as against 30-34% in Trans Gangetic Plains (Punjab and Haryana) (Fig. 2). The seed replacement rate, especially in pulses is low (Fig. 3 & 4). The per capita income in the MIGP is very low (Rs. 16083 in Bihar and Rs. 19512 in eastern UP) as compared to the national average (Rs. 39904) (Fig. 5).

Nevertheless, the challenge of increasing food production in the region in line with demand grows ever greater; any perturbation in agriculture will considerably affect the food systems of the region and increase the vulnerability of the resource-poor population. Increasing regional production is already complicated by increasing competition for land resources by non-agricultural sectors and by the deterioration of agri-environments and water resources.

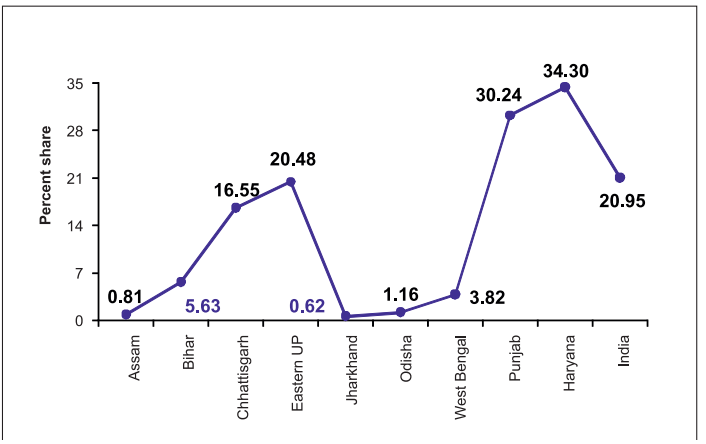

Fig. 2. Electricity consumption in agriculture sector (%)

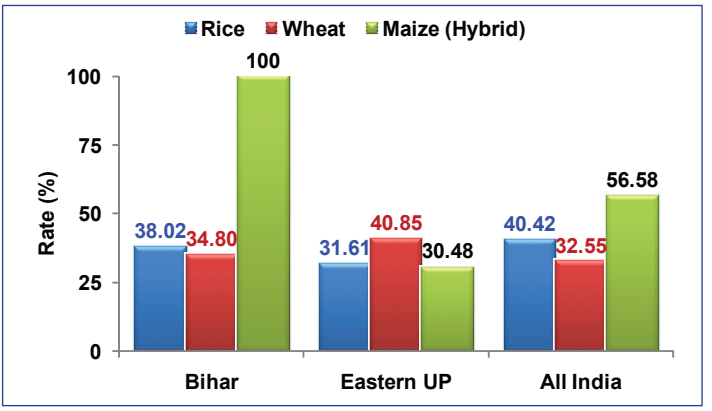

Fig 3. Seed replacement rate in major crops

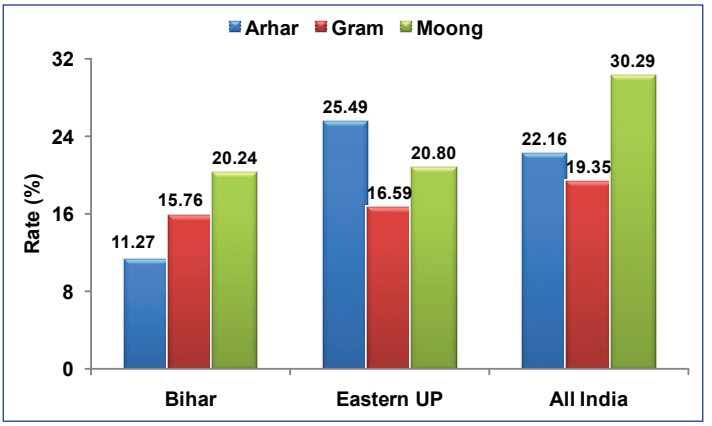

Fig 4. Seed replacement rate in important pulses

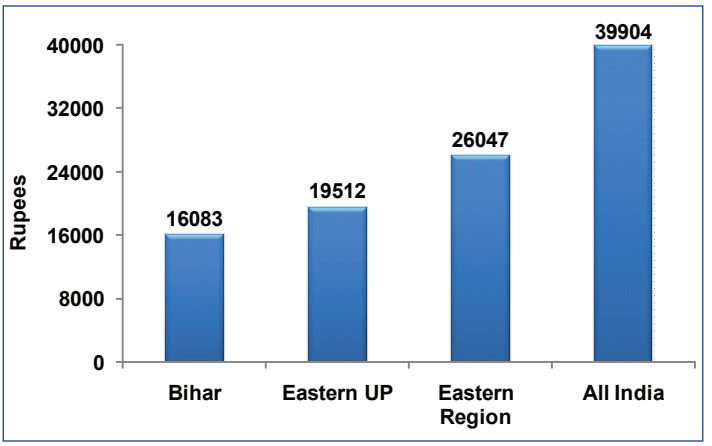

Fig 5. Per capita income in the region

Policy Workshop for MIGP

One-day workshop was organized under the Chairmanship of J. S. Sandhu, DDG (Crop Science) for identifying the production and technological gaps in middle IGP regions. The meeting was attended by large number of participants from various ICAR institutes, SAUs, KVKs, NGOs, Policy makers, State Government officials and farmers of the region. At the outset Director, ICAR-RCER, Patna welcomed the participants of the Workshop. The Chairman briefed participants the very purpose of organizing this workshop. He urged the participants to flag the technological, educational, marketing and policy gaps of the region so that a road map could be prepared to bridge these identified gaps. Dr. Bhatt Director ICAR-RCER, Patna gave a detailed presentation on the present status of agriculture in middle Gangetic plains and set the stage for further discussion.

Farmers of different districts of middle IGP raised number of problems related to production, processing, marketing and value addition of their produce (food grains, vegetables, milk, poultry, fish, animals, mushroom, etc). Some of the common major problems were:

- Processing, packaging, storage and marketing of agricultural products (Mushroom, Bee keeping, food grains, fish etc.)
- Non-availability of agricultural inputs in time (quality seed, fertilizers, irrigation, herbicides etc.)
- Fragmented agricultural land holding.
- Less availability of electricity for agricultural operation.
- Non-availability of stress tolerant (drought, submergence and salinity) crop varieties.
- Farm mechanization (paddy transplanter, zero tillage, harvester etc.)
- Mastitis and sterility problem in cattle.
- Non-availability of agricultural credit.
- Less market value and late payment of farmers produces.
- Crop damage by blue bulls.

Scientists from KVKs desired that the KVKs should be more strengthened in terms of scientific staff, finance and new technologies,

so that they could cater the need of farmers more effectively. The major common issues with KVKs were:

- Improvement in package of practices in respect of changing climate scenario.
- Timely availability of water, electricity, quality seeds and fertilizers.
- Short and medium duration drought tolerant rice varieties.
- Establishment of mini seed processing units/mobile processing units.
- Training of KVKs staffs and farmers.
- Farm equipments/implements for small and marginal land holdings
- Management of post-harvest losses.
- Lack of marketing intelligence among farmers.
- Arsenic contamination in irrigated water and crops.
- Need for crop diversification.

Directors of various ICAR institutes, scientists from SAUs and CGIAR institutions (CIMMYT, BISA), and planners and policy makers of the middle IGP also expressed their views. It was agreed that number of viable agricultural technologies are available, but their effective implantation in the region is the major issue. Zero-tillage is gaining popularity among farmers in IGP and state governments are providing subsidy on purchase of zero-till seed drills. Availability of quality seed of pulses is a major issue. In fishery sector, there is a need of networking between state government-fish farmers-hatchery owners. Other issues discussed were: requirement of training on maize seed production and ethanol production, custom hiring of farm implements and promotion of entrepreneurship, need of light weight paddy transplanter for wet soil condition, development of soil fertility maps, crop diversification with inclusion of pulses and millets, short duration rice cultivars and long duration wheat cultivars for rice-wheat system, development of district wise technologies inventories and modules, agri-clinic, soil testing labs, water saving technologies and small farm mechanization. On educational front, it was agreed that there is a need for up gradation of agricultural colleges, universities and KVKs for quality outputs rather than increasing their numbers.

Recommendations/actionable Points

- There is a need to ensure timely availability of assured quality agricultural inputs (seed, fertilizers and pesticides) and to develop marketing intelligence system and procurement of farmers produce on MSP. **(Action: State Deptt. of Agriculture of Bihar and Uttar Pradesh, SAUs and ICAR institutes of the region).**
- Since, 75% farmers of the region are small and marginal, small farm mechanization implements, like power tiller, weeder, small scale planters, mechanical transplanter for rice, seed drills, maize sheller, wheel hoe, sprayers, reaper etc. should be made available preferably through custom hiring and agri- service centers at subsidized rates. **(Action: ICAR-CIAE, Bhopal/ State Deptt. of Agriculture).**
- Availability of quality water for drinking (for human and animals) due to increasing problems of heavy metals like arsenic in some parts of the region is a major concern. For the storage of excess water during rainy season, de-silting of old water storage structures, water harvesting, reducing conveyance losses through lining of channels and promoting micro-irrigation systems is required to increase the water-use efficiency **(Action: ICAR Institutes/SAUs/State Deptt. of Agriculture)**.
- Alternate sources of energy, particularly solar energy, should be harnessed for agriculture, agro-processing and rural living since the region is blessed with 250-300 bright sunshine days/ year. There is a need to promote solar pumps for irrigation as availability of electricity is a major problem in the region. Subsidy should be given on purchase of solar energy-based machineries. **(Action: State Deptt. of Agriculture/GOI).**
- Deterioration of soil health (depletion of soil organic carbon) in the IGP is a major concern. Soil organic carbon need to be improved through conservation agriculture (zero-tillage), stopping residue burning, crop diversification with inclusion of legumes in the cropping system. Development of soil fertility maps at micro level is needed. **(Action: ICAR Institutes/SAUs/State Deptt. of Agriculture).**
- Sizeable area in middle IGP is under low land ecology. There is a need to diversify the aquatic crops like makhana, chestnut,

etc. with fish, water lily, sweet fleg and kewra. More research and demonstration is needed on this aspect (Action: ICAR Institutes/SAUs/KVKs).

- Non availability of quality seeds of pulses at appropriate time to the farmers is the major cause of lower productivity. The KVKs should also take seed production of new varieties at small scale level. For seed processing, mobile processing plants need to make available to KVKs. Hybrid seed production system, particularly in rice and maize, need to be developed and popularized on large scale. **(Action: NSC/ICAR Institutes/ SAUs/KVKs/State Deptt. of Agriculture).**
- Damage of crops by wild animals like blue bulls, wild boars, deers, monkeys, etc. is also a major problem with farmers. Appropriate policy steps need to be taken by the Government to stop such losses. **(Action: GOI/State Govts/Forest Deptt.).**

The workshop ended with the vote of thanks proposed by the Dr. J. S. Mishra, Head, Division of Crop research, ICAR-RCER, Patna and convener of the workshop.

Photo Gallery

Chairman's opening remarks during inaugural session

Women farmer expressing her views during the session

Progressive farmer, Shri K.N. Sharma, expressing his views

Participants of the worksop

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