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Agricultural Water Management Plan for Bargarh District of Odisha

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Abstract: Bargarh district of Odisha is located in the agro-climatic zone no. VII (Eastern Plateau and Hills Region) of India. This district is endowed with rich natural resources and tremendous scope exists for enhancing agricultural productivity through sound water resource management. Hence, an attempt was made to analyze the strengths, weaknesses, opportunities and threats (SWOT) of this district with regard to agricultural sector in general and to formulate a plan on integrated water resource management plan. Technological interventions are suggested based on their natural resource endowment scenario. Strategies for integrated water resource development in proportion with the targets proposed in district irrigation plan (DIP) have been formulated. The improved water management interventions such as raised and sunken bed technology and secondary reservoir in canal irrigated areas are suggested for enhancing water use efficiency.

Key words: Bargarh district, Integrated water resource management plan, Odisha

INTRODUCTION

Bargarh district of Odisha is located in the agro-climatic zone no. VII *i.e.* Eastern Plateau and Hills Region of India (Fig. 1). Its normal rainfall is 1367 mm and it has variety of soils *i.e.* vertisols, inceptisols and alfisols. It has geographic area of 5,83,700 ha with cropping intensity of 133%. It comprises of 12 blocks *i.e.* Attabira, Bargarh, Barpali, Bheden, Bhatli, Ambabhona, Sohela, Bijepur, Padmapur

(Rajborasombar), Gaisilet, Paikmal and Jharbandh (Fig. 1). Spatial variability exists in the amount and distribution of rainfall, water resource development, land topography and soil types in these blocks.

Land topography shows wide variation among different blocks in Bargarh district. Six blocks namely Bargarh, Barpali, Bheden, Attabira, Bhatli and Ambabhona have terrain as plain lands whereas undulating, mountainous and some plain lands is

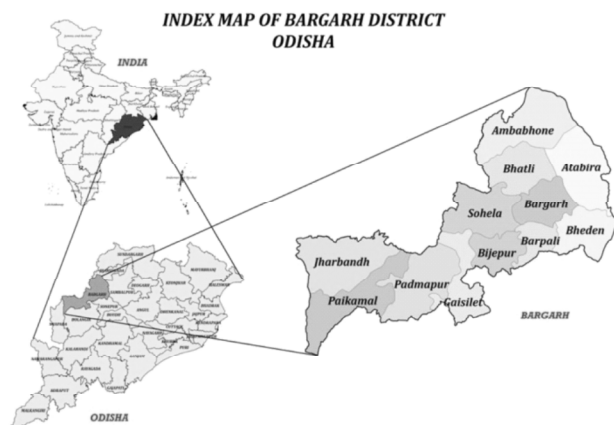


Fig. 1: Index map of Bargarh district of Odisha

(Source: <http://odishawatch.in/letter-submitted-speed-proposed-irrigation-projects-bargarh-district/>)

found in other six blocks.

Inceptisols is the predominant soil order and covers a large area in the district. Other important soil orders in Bargarh district are vertisols, entisols, inceptisols, alfisols. Analysis of terrain or land slope in the district varies from plain land to mountainous above 25% slope in 12 blocks. Tremendous scope exists in the district for construction of many minor irrigation schemes with reservoirs or diversion structures for providing gravity irrigation due to presence of undulating land. The agriculture is the major land use having 70.4% of the total geographical area followed by forest (12.48%), pastures (3.4%). Agriculture land use includes net sown, cultivable waste, land under miscellaneous tree crops and groves, and fallows Land (Fig. 2). The average cropping intensity is 133%. and net sown area constitutes 86.10% of the total agriculture area. Area sown more than once is higher in Attabira, Bheden, Bargarh and Barapali. On the contrary the area sown more than once is lesser in Padampur, Gaisilet and Bijepur. This is mainly attributed to large variation in irrigation facilities among different blocks in the district.

The surface water resources in the Bargarh district account for about 0.88294 BCM and 0.79130

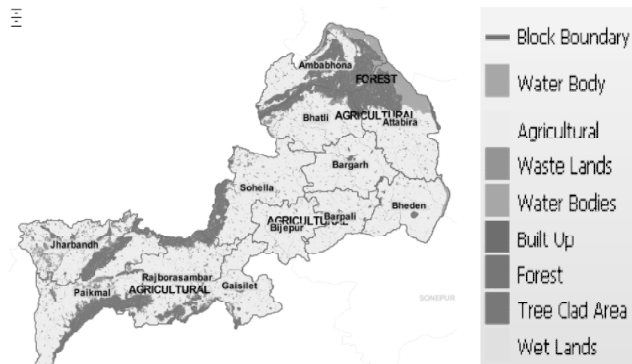


Fig. 2. Land use land cover map of Bargarh district

BCM during *kharif* and *rabi* seasons respectively (District Level Implementation Committee, Bargarh, Odisha, 2016). Total surface water requirement for 100 % utilization of presently installed irrigation structure is about 1.67424 BCM. Similarly, the groundwater resources of the district constitute about 0.46054 BCM. All blocks fall under safe category based on study conducted by CGWB, Bhubaneswar. Present ground water recharge rate is much more than draft and various irrigation structures also help in recharge of aquifer hence there is increase in ground water potentiality. Presently, installed irrigation facilities use only 0.001452 BCM ground water during *kharif* and 0.0010948 BCM ground water during *rabi* season. Total ground water requirement for 100% utilization of presently installed irrigation structure is about 0.0025468 BCM. However, all irrigation structures are not operating at their full potential through out the year.

Lot of variation exists among different blocks of Bargarh district of Odisha in the net irrigated area. Some blocks have net irrigated area more than 60% whereas some other blocks have less than 35% (Fig 3). For example, the blocks viz. Bargarh, Bheden, Barapali being irrigated through Hirakud major irrigation project has higher percentage coverage on irrigation. Total irrigation potential created till the end of 3rd quarter of 2015-16 was 1, 81,896 ha. Minor irrigation division have control over 19464.66

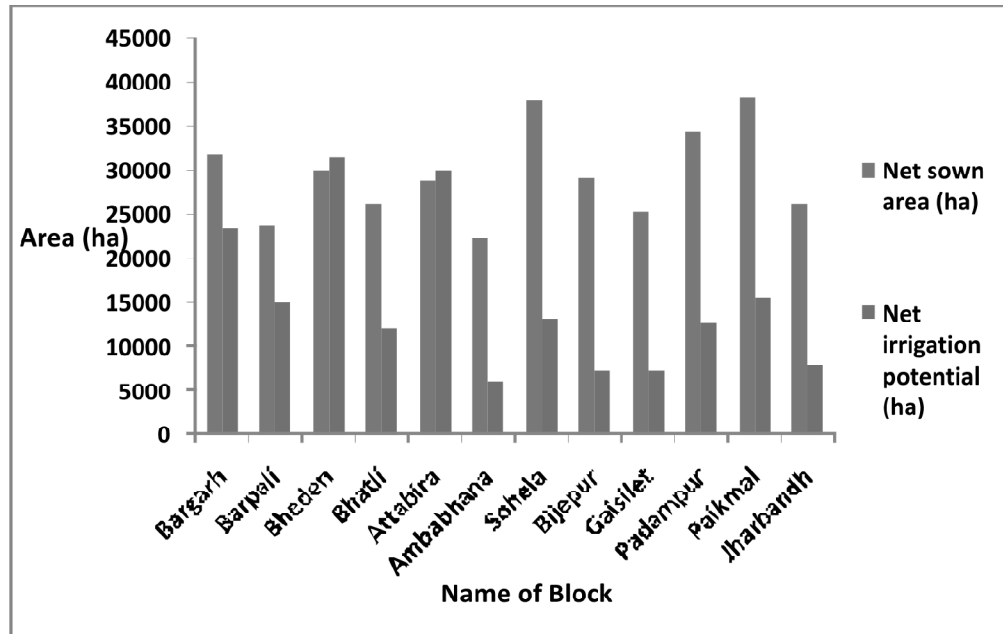


Fig. 3: Net sown area (ha) and net irrigation potential (ha) of different blocks of Bargarh district

ha. by means of check dam and other minor irrigation system. Minor irrigation division has so far constructed 600 check-dam spread over entire district. Maximum irrigated area is covered under paddy followed by maize and ground nut in *keharif* season. Similarly maximum irrigated area is under paddy followed by vegetables, Onion and chilly during rabi season. Paddy cultivation is the highest in Bheden block whereas it is the lowest in Ambabhona block.

Ample scope exists for further development of water resources so that the agricultural productivity of the district can be enhanced from its present level. To accurately implement the same, sound planning for agricultural sector is required based on the existing natural resources. Keeping above points in consideration, a sound agricultural water management plan has been prepared for Bargarh district, Odisha.

MATERIAL AND METHODS

Existing status of soil, water and biotic resource of the district were analyzed and future potential of these resources was also assessed. Categorization of

the blocks has been made under three potential criteria *i.e.*

- i) High potential-high productivity zone
- ii) High potential-low productivity zone and
- iii) Low potential-high productivity zone.

The blocks with more than 5 t/ha of rice productivity have been categorized as high productivity zone. Similarly, the blocks with higher water resources vis a vis water demand have been categorized under high potential zone. Three components of district irrigation plan are considered under the present study *i.e.* alternate crop planning and water use efficient technologies for business as usual scenario, water resource and crop planning in proportion with targets fixed in the DIP and block-wise integrated farming system models. The secondary data on the existing natural resources and targets fixed for next five-year period under DIP have been collected from websites of PMKSY (<https://pmksy.gov.in/>), Office of Deputy Director, Agriculture, Bargarh district and Office of Executive Engineer, Bargarh. The data was also collected from sources of Government of India

i.e. Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare (www.dacnet.nic.in) and Government of Odisha, Rashtriya Krishi Vikas Yojna (RKVY). Interaction was made with these state government functionaries regarding existing status of natural resources, their planning strategy for agricultural development, various components of existing agricultural schemes etc. Interacted with the farmers regarding their opinion about the present cultivation aspects and experience in integrated farming system. Interaction was also made with staff of Krishi Vigyan Kendra (OUAT), Bargarh and the views of the Programme Coordinator and Subject Matter Specialists were also taken into consideration while preparing this plan.

RESULTS AND DISCUSSION

SWOT analysis has been made for identification of strengths, weaknesses, opportunities and threats.

SWOT analysis

Strengths

- Climate, soil and bio-diversity present in the district for diversified farming systems.
- Fertile soil and most highly productive soils.
- Rich and diversified inland and marine aquatic resources.
- Strong three tier Panchayati Raj System adopted in the district.
- Presence of Orissa university of Agriculture and Technology at Chiplima which has been providing advisory service and training to farmers on various technology interventions.
- Krishi Vigyan Kendra of OUAT, Bargarh has been imparting training programme for the farmers.

- Favorable weather for animal husbandry especially poultry farming.

Weaknesses

- Farmers mostly belong to small and marginal category due to fragmented land holdings.
- Uneven distribution of rainfall leading to water scarcity in *rabi* and excess water in *kharif*.
- Inadequate irrigation facilities in some parts of the district especially in Gaisilet block.
- Poor infrastructural facilities for input supply, agro-marketing, storage and processing.
- Imbalances and insufficient nutrient management practices and inadequate application of organic matter in the field.
- Low level of awareness amongst farmers about diversification and use of modern technology.
- Lack of awareness regarding seed treatment facilities.
- Inadequate market facility.

Opportunities

- Favorable weather for growth and development of diversified crops.
- Scope for cultivation of profitable crops instead of conventional crops.
- Increased scope for production of vegetable, potato, oilseed and pulses.
- Scope for availability of agricultural labour.
- Scope for introduction of HYVs and hybrid varieties of crops.
- Alternate land use system with agri – horticulture, floriculture, timber cultivation etc.

- Introduction of forage crops like *Cenchrus ciliaris*
- Ample scope for livestock rearing
- Scope for development of seed village for self-sufficiency of good quality seeds.
- Scope for involving SHGs for poultry, goatery, duckery, dairy etc.

Threats

- Poor income group farmers have no access to adopt modern agricultural technologies.
- Lack of forward and backward linkages.
- Increased fragmentation of land holdings day by day.
- Illiteracy of the farmers inhibits the dissemination of improved agricultural knowledge.
- Inadequate availability of certified seeds of agricultural crops.
- Scientific method of poultry rearing is not proper in remote areas.

Classification of blocks based on potential and productivity

The blocks of Bargarh district have been classified under three different heads, *i.e.*

- i) High potential-high productivity zone
- ii) High potential-low productivity zone and
- iii) Low potential-high productivity zone and it was found that none of these blocks fall under the category of low potential-low productivity zone.

This would facilitate adopting diverse strategies for respective category of blocks. The blocks with more than 5 t/ha have been categorized as high productivity zone. Similarly, the blocks with higher water resources vis a vis water demand have been categorized under high potential zone. Four blocks

come under high potential-high productivity zone, four blocks come under high potential-low productivity zone and four blocks come under low potential-high productivity zone (Table 1).

COMPONENTS OF AGRICULTURAL WATER RESOURCE MANAGEMENT PLAN

Alternate cropping pattern plan in business as usual scenario for irrigated condition

Based on the climate, type of soil and other natural resource scenario, alternate cropping pattern plan has been prepared for irrigated ecosystem for business as usual scenario and presented in Table 2.

Alternate cropping pattern plan in business as usual scenario for rainfed condition

Based on the climate, type of soil and other natural resource scenario, alternate cropping pattern plan has been prepared for rainfed ecosystem business as usual scenario and presented in Table 3.

Block-wise suggested water management interventions in business as usual scenario

The twelve blocks of Bargarh district have significant variation in their natural resources and hence their management strategies have to be formulated accordingly. The block wise suggested water management interventions for business as usual scenario are presented in Table 4.

Integrated Water Resource/Irrigation Plan for Bargarh district

Based on the status of ground water and canal water resources in different blocks of Bargarh district, an integrated water resource / irrigation plan has been prepared. The data compiled in the district irrigation plan for Bargarh district and the information collected from O/o Executive Engineer, Water Resources, Bargarh, Government of Odisha have been taken into consideration.

Table 1
Classification of blocks based on potential and productivity

Sr. No.	Name of zone	Name of blocks
I.	High Potential-High Productivity	Bhatli, Ambabhona, Sohela, Jharbhandha
II.	High Potential-Low Productivity	Bijepur, Gaisilet, Padampur, Paikmal
III.	Low Potential-High Productivity	Bargarh, Barpali, Bheden, Attabira

Groundwater status of Bargarh district

Groundwater development in 4 blocks (Attabira, bargarh, Bheden, Barpalli) is about 27%. The average groundwater table depth during pre and post monsoon season is 3.82m and 2.56m, respectively. As this block is continuously fed under canal irrigation system, there is scope of utilizing shallow aquifer through construction of dugwells along the canal irrigation system. This would be helpful to provide required amount of water during the water stress period.

Out of 12 blocks, 8 blocks are under non canal command areas. The average groundwater development in these blocks is 22% (Fig. 4). The discharge in 2 blocks *i.e.* Ambabhona and Paikamal is nearly 10lps, whereas for other 6 blocks it is 4.46 lps (Table 5). The average groundwater table depth during pre- and post-monsoon season is 5.83m and 3.11m, respectively (Table 6).

Canal Irrigation system

Bargarh main canal having 25 distributaries with discharge of $107.54 \text{ m}^3\text{s}^{-1}$ at source delivery for a length of 84.28 km. The canal system is operated for a period of 135 days from 15th June to 30th October each year. So the total volume of water is discharged for the above period is 1,25,435 ha m approximately. The available delta for the command area of 133000 ha is 943 mm, which meets the present water requirement of *kbharif* paddy crop. As there is plenty of availability of canal water during this period and paddy being less intensive crop, it is not recommended to replace paddy for this area.

Similarly, during post monsoon season, canal delivery is for a period of 135 days (15th December to 30th April) with supply discharge of $107.54 \text{ m}^3\text{s}^{-1}$. Total command area is 99000 ha so the depth is nearly 1260 mm, hence farmers grow paddy during this period also as they are having pre notion of growing paddy during post monsoon season. For obtaining assured irrigation, sufficient number of auxiliary storage structures along the canal system can be proposed, which can cater the need of water requirement of paddy crop during dry spell.

However, there is immense scope for introducing on-dyke crops like coconut in paddy field bunds, which can fetch remuneration from 3rd year onwards instead of timber/fuel wood based existing sporadically in this region. Even if the water requirement of coconut crop is 141 day^{-1} , no additional provision of water is required for successful growing of this crop as irrigation amount can be met out from both sides of paddy field itself.

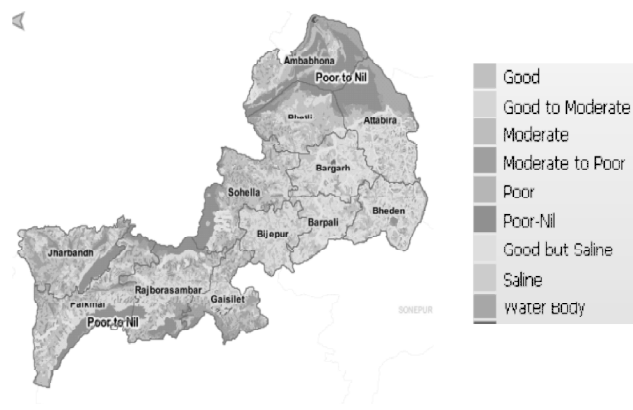


Fig. 4: Groundwater availability in Bargarh district

Table 2
Plan for alternate crop planning in Bargarh district in irrigated ecosystem

<i>S. No.</i>	<i>Name of block</i>	<i>Existing cropping pattern</i>	<i>Cultivated Area (ha)</i>	<i>Irrigated area (ha)</i>	<i>Alternate cropping pattern</i>	<i>Area proposed (ha)</i>	<i>Water Saving due to alternate cropping pattern</i>	<i>Additional area that can be brought under cultivation with alternate crops (ha)</i>
1.	Attabira	Rice-Rice, Rice-Blackgram Rice-greengram Rice-groundnut	31,288	31,288	Coconut* (on rice main field bunds) Rice-groundnut Arhar to be grown on rice bunds	2,500 ha 960 520	480 ha m	Groundnut and vegetable crops can be cultivated in additional area of 266 ha and 214 ha respectively with the water saving resulted from alternate cropping pattern.
2.	Bargarh	Rice-Rice	33,034	24,975	Coconut* (on rice main field bunds) Rice-groundnut Arhar to be grown on rice bunds	2,000 ha 960 520	480 ha m	Groundnut and vegetable crops can be cultivated in additional area of 266 ha and 214 ha respectively with the water saving resulted from alternate cropping pattern.
3.	Bheden	Rice-Rice	31,640	31,640	Coconut* (on rice main field bunds) Rice-groundnut	3,500 ha 480	480 ha m	Groundnut and vegetable crops can be cultivated in additional area of 133 ha and 107 ha respectively with the water saving resulted from alternate cropping pattern.
4.	Barpali	Rice-Rice	25,508	16,676	Coconut* (on rice main field bunds) Rice-groundnut	2,500 ha 480	480 ha m	Groundnut and vegetable crops can be cultivated in additional area of 133 ha and 107 ha respectively with the water saving resulted from alternate cropping pattern.

...Contd.

S. No.	Name of block	Existing cropping pattern	Cultivated Area (ha)	Irrigated area (ha)	Alternate cropping pattern	Area proposed (ha)	Water Saving due to alternate cropping pattern	Additional area that can be brought under cultivation with alternate crops (ha)
*Coconut grown on bunds doesn't require any additional irrigation; the water requirement of this crop is about 60-70 litres/day which can be conveniently met from the normal rainfall received in this district / block (1367 mm).								
5.	Bhatli	Rice-Rice Rice-Mustard Rice-greengram	35,773	21793	Rice-groundnut may be enhanced from present level Arhar to be grown on rice bunds	1,200	660 ha m	Vegetable crops like tomato, brinjal, okra, pointedgourd, capsicum can be grown in <i>rabi</i> season in about 1012 ha area due to additional water saving.
6.	Ambabhona	Rice-Rice Rice-Mustard Rice-greengram Greengram-mustard	35,857	19719	Rice-green gram may be enhanced from present level Arhar to be grown on rice bunds	1,800	990 ha m	Vegetable crops like tomato, brinjal, okra, pointedgourd, capsicum can be grown in <i>rabi</i> season in about 1518 ha area due to additional water saving.
7.	Sohela	Rice-rice Rice-mustard Greengram-mustard Groundnut-mustard	40,529	15,848	Rice-green gram may be enhanced from present level	1,200	660 ha m	Vegetable crops like tomato, brinjal, okra, pointedgourd, capsicum can be grown in <i>rabi</i> season in about 1012 ha area due to additional water saving.
8.	Bijepur	Rice-rice Rice-greengram Rice-groundnut Greengram-mustard Groundnut-mustard	30,217	8,575	Rice-groundnut may be enhanced from present level Arhar to be grown on rice bunds	1,200	660 ha m	Vegetable crops like tomato, brinjal, okra, pointedgourd, capsicum can be grown in <i>rabi</i> season in about 1012 ha area due to additional water saving.

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S. No.	Name of block	Existing cropping pattern	Cultivated Area (ha)	Irrigated area (ha)	Alternate cropping pattern	Area proposed (ha)	Water Saving due to alternate cropping pattern	Additional area that can be brought under cultivation with alternate crops (ha)
9.	Gaisilet	Rice-rice Rice-groundnut Rice-mustard Greengram-mustard Rice-greengram Greengram-mustard	31177	13,103	Rice-green gram may be enhanced from present level Arhar to be grown on rice bunds	1800	990 ha m	Vegetable crops like tomato, brinjal, okra, pointedgourd, capsicum can be grown in <i>rabi</i> season in about 1518 ha area due to additional water saving.
10.	Padampur	Rice-rice Rice-greengram Rice-mustard Greengram-mustard Groundnut-mustard	40,850	18,926	Rice-green gram may be enhanced from present level Arhar to be grown on rice bunds	1,800	990 ha m	Vegetable crops like tomato, brinjal, okra, pointedgourd, capsicum can be grown in <i>rabi</i> season in about 1518 ha area due to additional water saving.
11.	Paikmal	Rice-rice Rice-greengram Rice-mustard Rice-groundnut Greengram-mustard Groundnut-mustard	44,467	21,546	Rice-groundnut may be enhanced from present level Arhar to be grown on rice bunds	1,200	660 ha m	Vegetable crops like tomato, brinjal, okra, pointedgourd, capsicum can be grown in <i>rabi</i> season in about 1012 ha area due to additional water saving.
12.	Jharbandh	Rice-rice Rice-greengram Rice-field pea Greengram-groundnut	30,864	12,553	Rice-groundnut may be enhanced from present level Arhar to be grown on rice bunds	1,800	990 ha m	Vegetable crops like tomato, brinjal, okra, pointedgourd, capsicum can be grown in <i>rabi</i> season in about 1518 ha area due to additional water saving.

Table 3
Plan for alternate crop planning in Bargarh district in rainfed ecosystem

<i>S. No.</i>	<i>Name of block</i>	<i>Existing cropping pattern</i>	<i>Cultivated Area (ha)</i>	<i>Rainfed area (ha)</i>	<i>Alternate cropping pattern</i>	<i>Area proposed (ha)</i>
1.	Bargarh	Greengram-Field pea Arhar-Greengram Greengram-Sunflower	33,034	8,059	Arhar-sesamum Arhar-sunflower (Area to be enhanced) Arhar to be grown on rice bunds	700
2.	Barpali	Greengram-field pea Greengram-groundnut Groundnut-Sesamum	25,508	8,832	Groundnut-sunflower Groundnut-sesamum area to be enhance Arhar to be grown on rice bunds	900
3.	Bhatli	Rice-Mustard Rice-greengram	35,773	13,980	Rice-sesamum Arhar has to replace rice in its 10% cultivated area during Kharif.	800
4.	Ambabhona	Rice-Mustard Rice-greengram Greengram-mustard	35,857	16,138	Rice-sesamum Arhar to be grown on rice bunds	900
5.	Sohela	Rice-mustard Greengram-mustard Groundnut-mustard	40,529	24,681	Rice-sesamum Arhar has to replace rice in its 10% cultivated area during <i>Kharif</i> .	1000
6.	Bijepur	Rice-greengram Greengram-mustard Groundnut-mustard	30,217	21,642	Rice-sesamum Arhar has to replace rice in its 10% cultivated area during <i>Kharif</i> .	900
7.	Gaisilet	Greengram-mustard Rice-greengram Greengram-mustard	31,177	18,074	Rice-sesamum Arhar has to replace rice in its 10% cultivated area during <i>Kharif</i> .	800
8.	Padampur	Rice-greengram Rice-mustard Greengram-mustard	40,850	21,924	Rice-sunflower Greengram area has to be increased by 15% during <i>rabi</i> season. Arhar to be grown on rice bunds	1200

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Agricultural Water Management Plan for Bargarh District of Odisha

<i>S. No.</i>	<i>Name of block</i>	<i>Existing cropping pattern</i>	<i>Cultivated Area (ha)</i>	<i>Rainfed area (ha)</i>	<i>Alternate cropping pattern</i>	<i>Area proposed (ha)</i>
9.	Paikmal	Rice-greengram Rice-mustard Greengram-mustard	44,467	22,921	Rice-sesamum Rice-sunflower Arhar has to replace rice in its 10% cultivated area during <i>Kharif</i> .	800
10.	Jharbandh	Rice-greengram Rice-field pea	30,864	18,311	Rice-groundnut Arhar has to replace rice in its 10% cultivated area during <i>Kharif</i> . Arhar to be grown on rice bunds	700

Table 4
Suggested water management interventions for Bargarh district

<i>S.No.</i>	<i>Name of block</i>	<i>Suggested water management intervention</i>
1.	Attabira	<ul style="list-style-type: none"> • Farm pond • Renovation of field channel/ construction of new field channels. • Renovation of drainage system. • Raised and sunken bed system for small and marginal farmers
2.	Bargarh	<ul style="list-style-type: none"> • Raised and sunken bed system for small and marginal farmers • Farm pond • Two stage rain water harvesting technique • Renovation of field channel/construction of new field channels. • Renovation of drainage system.
3.	Bheden	<ul style="list-style-type: none"> • Farm pond • Renovation of field channel/ construction of new field channels. • Renovation of drainage system. • Raised and sunken bed system for small and marginal farmers.
4.	Barpali	<ul style="list-style-type: none"> • Farm pond • Raised and sunken bed system for small and marginal farmers • Renovation of field channel/construction of new field channels. • Renovation of drainage system.
5.	Bhatli	<ul style="list-style-type: none"> • Field bunding/graded bunding/contour bunding. • Tank-cum-well system-tank can be dugout type or embankment type. • Percolation tank. • Dug-out sunken pond. • Check dams/ diversion weir on well defined nala.

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S.No.	Name of block	Suggested water management intervention
6.	Ambabhona	<ul style="list-style-type: none"> • Exploitation of groundwater through open dugwells for small and marginal farmers in tailreach of minor command areas. • Two stage rain water harvesting technique • Renovation of field channel/construction of new field channels.
7.	Sohela	<ul style="list-style-type: none"> • Tank cum well system-tank can be dugout type or embankment type. • Percolation tank. • Paired-row planting in groundnut. • Secondary reservoir concept. • Dug-out sunken pond.
8.	Bijepur	<ul style="list-style-type: none"> • Tank cum well system-tank can be dugout type or embankment type. • Paired-row planting in groundnut. • Percolation tank. • Dugout sunken pond.
9.	Gaisilet	<ul style="list-style-type: none"> • Raised and sunken bed system. • Paired-row planting in groundnut. • Two stage rain water technique. • Use of groundwater through open dugwells for small and marginal farmers in tail reach of minor command areas. • Renovation of field channel/construction of new field channels.
10.	Padampur	<ul style="list-style-type: none"> • Use of groundwater through open dug wells for small and marginal farmers in tail reach of minor command areas. • Renovation of field channel/construction of new field channels. • Paired row planting in groundnut.
11.	Paikmal	<ul style="list-style-type: none"> • Tank-cum-well system. • Paired-row planting in groundnut. • Two stage rain water harvesting technique. • Dug-out sunken pond.
12.	Jharbandh	<ul style="list-style-type: none"> • Tank cum well system-tank can be dugout type or embankment type. • Percolation tank. • Secondary reservoir. • Dug-out sunken pond.

Salient Recommendations and Conclusions

- The twelve blocks of Bargarh district have been classified into four zones *i.e.*
 - high potential-high productivity zone
 - high potential-low productivity zone and
 - low potential-high productivity zone.
- Technological interventions are suggested for all these three zones based on their natural resource endowment scenario and SWOT analysis.
- Strategies for integrated water resource development in proportion with the targets proposed in district irrigation plan (DIP) have been formulated.

Table 5
Block wise groundwater status in Bargarh district

<i>Blocks</i>	<i>Groundwater development (%)</i>	<i>Discharge, lps</i>	<i>Drawdown, m</i>
Attabira	28.67	3.67	26.35
Bargarh	35.77	3.27	22.12
Bheden	16.68	4.48	17.92
Barpalli	26.43	6.00	26.20
Average	26.88	4.35	23.14
Ambabhona	37.66	10.25	18.83
Bhatli	34.24	5.78	17.45
Bijepur	21.88	0.63	45.46
Gaisilet	22.61	8.60	10.36
Jharbandha	18.42	4.64	22.19
Padampur	15.74	2.47	23.44
Paikmal	12.05	10.07	10.41
Sohella	14.16	4.66	24.14
Average	22.09	4.46	21.53

Table 6
Average groundwater table depth in Bargarh district

<i>Blocks</i>	<i>Groundwater table depth, m</i>	
	<i>Pre monsoon</i>	<i>Post monsoon</i>
Attabira	2.87	2.33
Bargarh	3.85	2.61
Bheden	3.52	2.06
Barpalli	5.04	3.26
Average	3.82	2.56
Ambabhona	5.85	3.15
Bhatli	5.39	2.65
Bijepur	5.34	3.08
Gaisilet	5.87	2.83
Jharbandha	6.15	3.08
Padampur	5.80	2.91
Paikmal	5.79	3.80
Sohella	6.45	3.41
Average	5.83	3.11

- Alternate crops with low water requirement have been suggested to enhance the cultivated area from the present in business as usual scenario in all the blocks.
- About 10-20% of the diversification from rice to vegetables, pulses or oilseeds during *rabi* season is recommended depending upon the land situations and assured water supply.
- The improved water management interventions such as raised and sunken bed technology, two stage rainwater harvesting technique, optimum crop geometry, secondary reservoir and tank cum well system have been suggested for enhancing water use efficiency in the business as usual scenario.
- Utilizing rice main field bunds for integrating coconut plantation has been suggested for four blocks *i.e.* Attabira, Bargarh, Barpali and Bheden.
- Growing redgram on rice field bunds is suggested to be taken up in large scale.

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