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Agricultural land use planning

an effective means of enhancing tribal farmers' income in Asom

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The north-eastern region of India is blessed with rich biodiversity, wide range of agro-climatic conditions and varied topography, which offer vast potentiality for agriculture in this region. However, the region is lagging much behind in agricultural development compared to the other region of the country. The reasons include injudicious use of land resources, poor dissemination of new agro-technologies, low consumption of fertilizers and inadequate infrastructure facilities. Agriculture is the major economic activity in the region and majority of the population, including tribals, are dependent on agriculture. Interestingly, adoption of modern agricultural technologies is still lower among the tribal population accounting for 27% of the total population in the north-eastern region.

Key words: Cropping, Farmers' income, Land, North-east India, Tribals

ASOM is strategically an important state, in north-eastern region, having the largest share in the production of total food grains and oilseeds. However, due to lack of appropriate strategies on agricultural land use planning and improper use of the existing land resources, the agricultural production system in the tribal areas of the State is predominantly restricted to rainfed monocropping at subsistence level. Accelerated agricultural development in the tribal areas of the state can be achieved by identification and prioritization of the site-specific constraints, resolving issues related to crop production and transfer of appropriate agro-technologies. To boost agricultural production and productivity in the region as a whole, appropriate agricultural land use planning is the hour of need. Effective and appropriate land use planning for optimum utilization of available farm level resources with scientific aid and adequate extension services are the important means to elevate the agricultural scenario of the region by many folds. Hence, managing the existing land resources of the region through adoption of appropriate land use plan is of tremendous significance as far as agricultural sustainability and food security are concerned. This is also true for the tribal areas of Asom. Generation of soil and land resource information is the pre-requisite for agricultural land use planning. Land evaluation and soil-site suitability assessment for crops based on soil resource database to choose appropriate crop for cultivation are the effective means for enhancing crop production as well as farmers' income. Adoption of appropriate land use plan based on soil resource information with scientific management practices for crops are the long-felt needs for enhancing farmers' income in Asom, particularly in the tribal areas of the State.

Impact of research

To implement agricultural land use planning on the basis of soil resource information and socio-economic condition, three tribal villages namely, Upper Deurigaon, Bahphala and Nam Deurigaon of north-west Jorhat development block of Jorhat district of Asom were selected. The villages fall under the Upper Brahmaputra Valley Agro-climatic region of Asom. *Deuri* and *mishing* tribes constitute the major share of the total population of the villages. The major constraints identified with respect to agricultural practices are poor levels of farm management due to lack of technical know-how, inaccessibility to good quality seeds and other agri-inputs, and mono-cropping due to lack of suitable crop planning. To address the constraints, a holistic effort was made at the village level. A three-tier approach with detailed characterization and mapping of soils at cadastral level for the development of site-specific agricultural land use planning, dissemination of technical know-how on crop management practices under '*Mera Gaon Mera Gaurav*' initiative of Indian Council of Agricultural Research and implementation of the suggested land

use plan through Tribal Sub-plan programme (recently renamed as Scheduled Tribe Component, was taken up in the tribal villages.

Soil resource inventory for agricultural land use planning

Detailed soil survey was conducted at 1:4,000 scale in the tribal villages. The soils are deep to very deep, imperfectly to well drained, coarse loamy to sandy in texture occurring in nearly level flood plains with slight to moderate erosion. Soils were classified following Soil Taxonomy. Soil series identified in the villages are presented in Table 1.

Soil resource information was used to assess soil-site suitability of crops for developing alternate land use options. Socio-economic data were also collected from the households to suggest the appropriate land use options for the tribal villages. Before the intervention, agricultural practices in the tribal villages were mainly confined to monocropping of paddy during *kharif*; the *rabi* being fallow. Other parts of the villages were kept as permanent fallow due to existing crop production constraints, particularly coarse soil texture. Therefore, intervention was made with appropriate strategy to make agriculture a profitable venture with increased production and farm income.

On the basis of soil characteristics and location-specific crop production constraints, site-specific alternate land use options were developed for the tribal villages (Table 1).

Agro-technology transfer under *Mera Gaon Mera Gaurav*

Technical know-how on crop management practices was disseminated for harnessing the potentiality of the existing soil resources in the tribal villages. Emphasis was given on the dissemination of management practices for *rabi* crops, since land resources remain fallow mainly during *rabi*. Appropriate package of practices for mustard, potato and pea were suggested to the farmers through interaction meet at regular interval in the villages. Recommended management practices as per the State Agricultural University for the *rabi* crops are given in Table 2. Technical know-how on land preparation for various crops was also disseminated among the farmers.

Implementation of land use plan through tribal sub-plan programme

For the implementation of

Table 1. Site-specific land use options suggested for tribal villages in Jorhat district of Asom

Village	Soil	Texture	Present land use	Soil-site suitability	Suggested land use
Upper Deurigaon	Upper Deuri-1 *Typic Fluvaquents*	Loamy sand	Current fallow	Rice (N2) Mustard (S2) Potato (S2) Pea (S3)	Mustard/potato/pea with appropriate management practices during *rabi*
	Upper Deuri-2 *Fluvaquentic Endoaquepts*	Sandy loam	*Kharif*: *Sali* paddy (*kharif* paddy)	Rice (S2) Mustard (S2) Potato (S2)	*Kharif*: *Sali* paddy (*kharif* paddy)
			Rabi: Fallow	Pea (S2)	*Rabi*: Mustard/ potato/ pea
	Upper Deuri-2 *Fluvaquentic Endoaquepts*	Silt loam	*Kharif*: *Sali* paddy (*kharif* paddy)	Rice (S2) Mustard (S2) Potato (S2)	*Kharif*: *Sali* paddy (*kharif* paddy)
			rabi: Fallow	Pea (S2)	*Rabi*: Mustard/ potato/ pea
Bahphala	Bahphala-1 *Typic Udipsamments*	Loamy sand	Current fallow	Rice (N2) Mustard (S2) Potato (S2) Pea (S2)	Mustard/potato/pea with appropriate management practices during *rabi*
	Bahphala-2 *Typic Fluvaquents*	Sandy loam	*Kharif*: *Sali* paddy (*kharif* paddy)	Rice (S3) Mustard (S2) Potato (S2)	*Kharif*: *Sali* paddy (*kharif* paddy)
			Rabi: Fallow	Pea (S2)	*Rabi*: Mustard/ potato/ pea
	Bahphala-3 *Fluventic Dystrudepts*	Loam	*Kharif*: *Sali* paddy (*kharif* paddy)	Rice (S2) Mustard (S2) Potato (S2)	*Kharif*: *Sali* paddy (*kharif* paddy)
			Rabi: Fallow	Pea (S2)	*Rabi*: Mustard/ potato/ pea
	Bahphala-4 *Fluventic Endoaquepts*	Silt loam	*Kharif*: *Sali* paddy (*kharif* paddy)	Rice (S2) Mustard (S2) Potato (S2)	*Kharif*: *Sali* paddy (*kharif* paddy)
			Rabi: Fallow	Pea (S2)	*Rabi*: Mustard/ potato/ pea
Nam Deurigaon	Nam Deuri-1 *Typic Fluvaquents*	Sandy loam	*Kharif*: *Sali* paddy (*kharif* paddy)	Rice (S3) Mustard (S2) Potato (S2)	*Kharif*: *Sali* paddy (*kharif* paddy)
			Rabi: Fallow	Pea (S2)	*Rabi*: Mustard/ potato/ pea
	Nam Deuri-2 *Fluventic Endoaquepts*	Silt loam	*Kharif*: *Sali* paddy (*kharif* paddy)	Rice (S2) Mustard (S2) Potato (S2)	*Kharif*: *Sali* paddy (*kharif* paddy)
			Rabi: Fallow	Pea (S2)	*Rabi*: Mustard/ potato/ pea

N2: Unsuitable; S2: Moderately suitable; S3: Marginally suitable

Table 2. Management practices suggested for *rabi* crops in tribal villages of Jorhat district of Asom

Crops	Management practices suggested under rainfed condition
Mustard (var. TS 38)	NPK @ 40:35:15 (kg/ha) and farmyard manure @ 3 tonne/ha
Potato (var. Kufri Jyoti)	NPK @ 60:50:50 (kg/ha) and farmyard manure @ 10 tonne/ha
Pea (var. Azad P1)	NPK @ 20:45:10 (kg/ha) and farmyard manure @ 4 tonne/ha

Table 3. Crop performance in farmers' field in the tribal villages of Jorhat district of Asom

Year	Village	Crop	Yield obtained at farmers' field (tonne/ha)	Average district level yield (tonne/ha)	*Yield gain (%)	Net income (₹/ha/yr)	B/C ratio
Rabi 2015	Upper Deurigaon	Mustard	1.60	0.75	113	64,250/-	4.08
		Potato	14.0	7.50	87	78,150/-	1.26
		Pea	1.40	0.50	180	33,500/-	1.49
	Bahphala	Mustard	2.40	0.75	220	96,375/-	6.12
		Potato	10.5	7.50	40	58,610/-	0.95
		Pea	1.30	0.50	160	31,100/-	1.39
	Nam Deurigaon	Mustard	1.08	0.75	44.0	43,368/-	3.04
		Potato	9.80	7.50	31	54,700/-	0.88
Rabi 2016	Upper Deurigaon	Mustard	1.50	0.75	100	36,753/-	3.33
		Potato	16.0	7.50	113	97,977/-	2.58
		Pea	1.40	0.50	180	28,685/-	2.78
	Bahphala	Mustard	1.40	0.75	87	33,253/-	3.11
		Potato	16.8	7.50	124	1,05,977/-	2.71
		Pea	1.10	0.50	120	19,085/-	2.18
	Nam Deurigaon	Mustard	1.80	0.75	140	47,253/-	4.00
		Potato	17.0	7.50	126	1,07,977/-	2.74
		Pea	1.00	0.50	100	15,885/-	1.99

*Yield gain was calculated as % increase in yield at farmers' field over district level yield

based on soil resource information is an effective means of increased production and profitability. Proper planning is very much essential in bringing fallow lands under cultivation. Appropriate suggested land use plans in the tribal villages, good quality seeds and fertilizers as per recommended doses were distributed among the farmers for growing mustard, potato and pea. To utilize the fallow period during *rabi*, inputs were supplied to the farmers for the most suitable *rabi* crops under Tribal Sub-plan (Scheduled Tribe Component) programme. Due consideration was given on the socio-economic status of the households while distributing seeds and fertilizers in the villages.

Observations on crop performance and farmers' income

Data on crop yield as obtained at farmers' fields were recorded and presented in Table 3 for two consecutive seasons namely, *rabi* 2015 and *rabi* 2016. The data on crop performance showed that on an average, the increase in yield for mustard, potato and pea at farmers' field over district level yield ranged from 44 to 220, 31 to 87 and 160 to 180%, respectively across the villages during *rabi* 2015; the corresponding values were 87 to 140, 113 to 126 and 100 to 180%, respectively during *rabi* 2016. In the present study, based on the available data on the existing market price of the produce in different years, net income generation and benefit-cost ratio (B/C ratio) were estimated. Data revealed that cultivation of mustard and potato could earn higher net return in monetary value as compared to pea. However, highest B/C ratio was obtained in mustard cultivation.

Results indicated that an additional benefit of ₹ 43,368 to ₹ 96,375/- was obtained by the farmers in different villages due to mustard cultivation during *rabi* 2015. Similarly, the benefit obtained from mustard cultivation ranged from ₹ 33,253 to ₹ 47,253/- during *rabi* 2016.

SUMMARY

Agricultural land use planning interpretation of soil resource database and assessment of soil-site suitability for agricultural crops play important roles for the selection of suitable crop for a particular area. Proper selection of crops coupled with appropriate management practices is of tremendous importance for increasing production and profitability of farming community. This becomes more significant while planning for fallow lands in tribal villages. Scientific land use planning along with proper implementation are the tools for enhancing farmers' income in agrarian society.

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