



Research Article

Deficit of cultivable land in India : threaten to self sufficiency of future agriculture

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ARTICLE CHRONICLE :

Received:
18.06.2013;

Accepted:
01.07.2013

KEY WORDS :

Cultivable land,
Projected demand

SUMMARY : Land is a finite natural national resource, directly link with all economic development activities. India is a land scarce country where per capita cultivated land is only around 0.15 ha (Planning Commission 2011) even though Indian agriculture highly depends upon large scale of land due to inefficiency in production. With the growth of a country's economy competition between agricultural and non agricultural sectors for land is intensifying due to increasing pressure on land for food production, housing and industrial expansion. The demand for food and other agricultural commodities sharply increased in upcoming years due to rising of population. Keeping this the paper attempted to study the cultivable land deficit for projection demand for 2020-21. The study based on secondary data collected various published sources. Compound growth rate and cultivable land deficit model was used to analyse the data. The compound growth rate analysis revealed that forest area and non agricultural uses of land records positive trend for all periods. The net cultivable area shows positive trend in pre liberalization periods but after marginal decrease. The projection results show that there is possibility of shrinking net cultivable area in 2020-21. According the projection demand for agriculture and other commodities the total cultivable land demand is around 279 million hectares at current yield level. Possibility of growing yield the growth projection was done based on past ten year growth used as proxy for next ten year yield growth. At this projected yield level cultivable land demand was estimated 229.94 million hectares. But the available cultivable land may around estimated 190 million hectares. The deficit cultivable land may be major constraint to maintain the self sufficiency in 2020-21. The only option for the policy makers to boost the farm yield by combined effort of intensification, extensification and control of agricultural land conversion made possible to meet out projected demand for various food commodities in 2020-21.

How to cite this article : Ravikumar, R. and Paramasivam, P. (2013). Deficit of cultivable land in India : threaten to self sufficiency of future agriculture. *Agric. Update*, 8(3): 348-351.

BACKGROUND AND OBJECTIVES

Land is a finite natural national resource, directly link with all economic development activities. India is a land scarce country where per capita cultivated land is only around 0.15 ha (Planning Commission 2011) even though Indian agriculture highly depends upon large scale of land due to inefficiency in production. With the growth of a country's economy competition between agricultural and non agricultural sectors for land is intensifying due to increasing pressure on land for food production, housing and industrial expansion. The demand for food and other agricultural commodities sharply increased

in upcoming years due to rising of population. According to Twelfth Plan Working Group on Crop Husbandry, project the demand for various commodities in 2020-21 based on per capita requirement for the projected population. The available net cultivable land available not much enough to attain the self sufficiency in 2020-21. With this background the research was made to attain the following objectives to study the growth of various categories of land uses in India, to estimate cultivable land deficit for self sufficiency of agriculture and to study the requirement growth of farm yield to attain the self sufficiency

Fahmuddin and Irwan (2006) studied the land

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use change and conversion of agricultural lands in Indonesia. They found 42 per cent of paddy fields converted to non agricultural uses and warned that if this conversion trend continues, there will be a dramatic escalation of the country's dependence on imported rice they suggested that optimum rate of land conversion to maintain agriculture self sufficiency for future population. Smeets (2007) predict available land for agriculture at global level in 2050. As a result of advancement of agricultural technology for food production, representing the (technical) potential to increase the efficiency of food production. Achieving the high side of this range would require a very drastic change of global agriculture, including for example landless animal production, genetically modified organisms and implementation of the best available technologies an very high levels of irrigation.

RESOURCES AND METHODS

Data collection :

The study was mainly based on secondary data collected from planning commission reports for land use statistics for past 60 years and agriculture related data collected from Ministry of agriculture.

Tools of analysis :

Compound growth rate:

Compound growth rate was used to find the trend of various land use categories for two different periods and over all period of 1950-51 to 2010-11. The formula used was

$$Y_t = a(1+r)^t U_t$$

when linearised, it becomes, $\ln Y_t = \ln a + t \ln(1+r) + \ln U_t$

β can be calculated using OLS regression from which r can be estimated as follows:

$$r = (-1) \times 100$$

where,

- $Y_t =$ Various land use categories in time t.,
- $r =$ Annual compound growth rate
- $U_t =$ $\ln U_t$ - error term
- $t =$ time in discrete years

Compound growth rate analysis was done for to study the trend of various categories of land use system for different periods.

Projected value estimation :

The following trend equation has been used to estimate the project major land use category for 2020-21 using the present trend. It helps to alter the land use pattern and use of advance technology according to future demand to maintain production of major food crops.

$$Y_{t+n} = A_0 b^t U$$

where,

Y_{t+n} = Projected value

A_0 - Constant term , b- Slope co-efficient, t-Time trend

Cultivable land deficit estimation :

In order to keep self-sufficiency for major crops, land deficit estimation need to be done for production planning how much demand for land to maintain the self sufficiency.

$$CLD_t = [PD_{t \text{ for crop 1}} / Y_{t \text{ of crop 1}} + PD_{t \text{ for crop 2}} / Y_{t \text{ of crop 2}} + \dots + PD_{t \text{ for crop n}} / Y_{t \text{ of crop n}}] - [PNCA_t + ASM - PSCA_t]$$

CLD_t = Cultivable land deficit at time t

PD_t = Projected demand of crop 1 to n

Y_t = Yield of crop 1 to n

$PNCA_t$ = Rejected net cultivable area at time t

ASM = Projected area sown more than once

$PSCA_t$ = Probability of shift in cultivable land to non-agri uses.

OBSERVATIONS AND ANALYSIS

The land use system was classified into three major sectors and growth rate was done for overall period and two

Table 1: Trend in various categories of land use system in India

Land particulars	Area (Mha)			ACGR (per cent)		
	1950-51	1990-91	2010-11	PL	POL	Overall
Ecological sector						
Forest	40.48	67.81	69.63	1.31**	0.16*	0.93**
Barren and uncultivable land	38.16	19.39	12.02	-2.84**	-2.51**	-1.79**
Other uncultivated land	19.83	3.83	3.4	-4.12*	-0.56*	-3.42*
Agricultural sector						
Net area cultivated	118.74	143.25	140.29	0.47**	-0.08*	0.30**
Fallow land	28.12	23.26	25.52	-0.39**	0.40**	-0.21**
Cultivable waste land	22.94	15	12.74	-1.06**	-0.63*	-1.00*
Non agricultural sector						
Area under non agricultural use	9.36	21.09	5.48	2.04**	0.96**	1.63**

Note: PL -Pre liberalization, (1950-51-1900-91) POL - Post liberalization (1990-91 to 2010-11),

* and ** Indicate significance of value at P=0.05 and 0.01, respectively

different periods *viz.*, liberalization and post liberalization because after liberalization the land use for non agricultural uses sharply rose. The growth rate analysis helps to overview

in the trend in land use for over the period.

It is seen that the area under forests has been significantly increasing over the years. It had increased from

Table 2 : Results of projected value of major land use category in 2020-21

Sr. No.	Particulars	Area (In Mha)	Trend
1.	Forest area	71.34	PT
2.	Non agricultural uses	28.21	PT
3.	Net cultivated area	139.33	NT
4.	Area sown more than once	51.64	PT
	Total cultivable area	190.97	

Note : PT – Positive Trend NT – Negative Trend

Table 3 : Estimation of cultivable land demand for various crops at current yield

Sr. No.	Crops	PD (MT)	TE yield (kg/ha)	CLD at TE yield (Mha)	% to TCLD	ECLD (Mha)
1.	Rice	117	2177.10	53.74	19.26	14.27
2.	Wheat	100	2980.85	33.55	12.02	4.3
3.	Coarse cereals	38	1504.45	25.26	9.05	5.04
4.	Pulses	25	621.71	40.21	14.41	16.63
5.	Oil Seeds	71	897.55	79.1	28.35	51.38
6.	Fruits	124	11445.37	10.83	3.88	4.20
7.	Vegetables	189	16842.43	11.22	4.02	3.04
8.	Sugarcane	312	66.86**	4.67	1.67	-0.16
9.	Cotton	25*	391.76	10.48	3.76	1.07
10.	Other crops	--	---	10	3.58	0

Table 4 : Estimation of cultivable land demand for various crops at projected yield

Sr. No.	Crops	PD (MT)	PGR of yield (%)	PY (kg/ha)	CLD at PY(Mha)	% to TCLD	ECLD (Mha)
1.	Rice	117	1.86	2570	45.53	20.06	6.06
2.	Wheat	100	0.69	3170	31.55	13.90	2.3
3.	Coarse cereals	38	2.47	1874	20.28	8.94	0.06
4.	Pulses	25	0.97	675	37.04	16.32	13.46
5.	Oil seeds	71	5.35	1437	49.41	21.77	21.69
6.	Fruits	124	2.42	14252	8.70	3.83	2.075
7.	Vegetables	189	1.53	19442.4	9.72	4.28	1.545
8.	Sugarcane	312	0.87	72.26	4.32	1.90	-0.51
9.	Cotton	25	0.50	409	10.39	4.58	0.98
10.	Other crops	--	---	---	10	4.41	10

Data Source of Projected Demand – Planning Commission of India, 2012-13, *in bales for cotton ** in tones for sugarcane

Note: PD – Projected demand , TE – Triennium ending , CLD – Cultivable land demand, PGR – Proxy growth rate , PY – Projected yield, MT – Million tones, Mha – Million hectare ECLD - Extended land demand over current area

Table 5 : Estimation cultivable land deficit at projected demand for various commodities

Particulars	Land area (Mha)
A Estimated total land demand for all crops at current yield	279.06
B Estimated total land demand for all crops at projected yield	226.94
C Projected net cultivable area	139.33
D Probability of shift of net cultivable land to non agricultural uses	5.02
E Projected area sown more than once (M ha)	51.64
F Total gross cultivable area (C+E-D)	185.95
D Cultivable land deficit at current yield (A-F)	93.11
H Cultivable land deficit at projected t yield (B-F)	40.99

40.48 million hectares in 1950-51 to 69.63 million hectares in 2010-11 (Table 1). It accounted 1.31 per cent in preliberalization period and 0.16 per cent and overall accounted 0.93 per cent at five per cent significant level. The other categories in ecological sectors recorded negative trend indicated promotional measures taken of planting in barren and cultivated land converted to forest area. Net cultivable area slightly increased in pre liberalization period after that it showed negative trend. It may be due to cultivable land conversion for non agricultural and other commercial uses. The land category evident that slight decreases in pre liberalization period was because of the coming under cultivable but in next period it again increased due to various problems in agriculture. After industrialization the demand for land in industrial zones highly increased result land transferred from agriculture resulting losses arable land. It recorded positive trend in all periods.

Projection of major categories of land use in 2020-21:

The projection was done for land use system in future for based on past growth particularly the growth taken of post liberalization value. The projection value of major land categories are given in Table 2.

The Table 2 revealed that according to the projection the net cultivable area may be reduced to 139.33 million hectare. The non agricultural uses of land may be increased to 28.31 million hectares probability taken from cultivable land then cultivable land still reduced than projected value.

Cultivable land demand for various crops in India :

According to working group on crop husbandry estimate the demand projection for various commodities in 2020-21. To meet out the projection demand in 2020-21, cultivable land demand for various crops was estimated at triennium ending yield. The current yield referred as triennium ending for last three years.

The Table 3 revealed that cultivable land demand for oilseeds led first (28.47) followed by rice. The huge cultivable land demand for oilseeds indicated the huge improvement over the current technology and necessary to meet the oilseeds demand. As for stable food crop rice and wheat together require more than 30 per cent of total cultivable land demand. Pulses also required around 14 per cent (37 million hectares) indicated the more

improvement in yield to meet the projected demand in future.

The yield projection was done for past 10 (2001-02 to 2011-12) years yield performance and growth rate taken up proxy for next 10 year growth in yield. From that cultivable land demand was estimated as 226.94 million hectares to meet out the projected demand for 2020-21. In this context the projected yield growth was not sufficient to meet out the projected demand with the growth and required around 40 million hectares of extended area for the above projected yield (Table 4).

Deficit of cultivable land at projected demand for various commodities :

The total demand for cultivable land at current yield is around 279.06 million hectares and for projected yields around 226.94 million hectares which is higher than available cultivable area. The cultivable land deficit at projected yield is around 40 million hectares, it is concluded that deficit for cultivable surely threaten to agriculture self sufficiency in 2020-21.

Conclusion :

Increasing population and reduced cultivable land due to agricultural land conversion twin constraint for self sufficiency. From the above results concluded that demand for cultivable land rising in 2020-21 according to projected demand. To attain the self sufficiency in major commodities the extended cultivable land demand is not possible with both current yield and projected yield. So combined effort of intensification, intensification and control of agricultural land conversion made possible to meet out projected demand in 2020-21.

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