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ECONOMIC EVALUATION OF PASTURE MANAGEMENT SYSTEMS IN ARID AREAS OF WESTERN RAJASTHAN

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ABSTRACT

The economic analysis of three alternative pasture production systems viz,, natural protected, natural protected with soil conservation measures and tne sown pasture with improved technology and soil conservation measures, was carried out in relation to grazing (sheep, cattle and mixed), fodder marketing and seed-fodder marketing options. All the options were economically viable under the identified production technologies. However, the improved technology for pasture production systems was found to be less cost-effective. To generate viable returns in the long-run, such cultivated pastures have to be near the fodder demand points.

INTRODUCTION

Most of the hot arid region (62%) in India is located in 11 districts of western Rajasthan (Krishnan, 1968). Crop production in this region suffers from chronic instability (Jodha and Vyas, 1969) owing to constrained resources endowments. From amongst the elements of agrarian product-mix, livestock has traditionally demonstrated an economic edge over other enterprises on account of relatively greater capacity to withstand rigours of arid environment. However, continuous increase in livestock leads to a sizeable decline in grazing lands. Further, pressure of human population (Mann et al. 1977) has put severe strain over the economic edge. If these lands are effectively managed for pasture production, livestock production/enterprise in the region could be more remunerative and attractive.

Bhati and Mruthyunjaya (1981) delineated three systems of pasture production: protected natural pasture, protected natural pasture with application of soil conservation measure (use of pitting disker), and sown pasture by cultivation of high yielding srains of *C. ciliaris*, *C. setigerus*, and *L. sindicus* with adequate fertilizer and management inputs. An integrated analysis of alternative pasture production systems in relation to available marketing and grazing options is not available. Therefore, comparative economic analysis of the three pasture production systems in relation to available options has been attempted in the present studies. Options of grazing (sheep, cattle and mixed herd) as well as market (sale of fodder and sale of seed and fodder) in relation to the alternative pasture production systems have been considered separately.

MATERIAL AND METHOD

The Data

The five options (three of grazing, two of marketing) were applied to each of the three pastures production systems. The data on physical quantities (for 4-6 yrs) pertaining to the Agrostological experiments on *C. ciliaris*, *C. setigerus* and *L. sindicus* grass species were employed. Grazing period for the options was assumed for 10 months beginning from September. The forage production on cultivated pastures was 6 tonnes per ha with 30-40 per cent of moisture. The forage yield was valued @ Rs 25 per q. In case of seed farming the dry forage yield was 4 tonnes after the harvest of 2 q of seeds/ha. The seeds were valued at Rs 1500 per quintal. The returns from grazing were derived from grazing fees currently charged for cattle (Rs. 40.00 per month), sheep (Rs. 6.00 per month) and heifers (Rs. 18.00 per month) on Government farms.

The economic viability of the usage and production components of the three pasture management systems was assessed on the bases of Net present value (NPV), Discounted Benefit-Cost Ratios (DB-CR), Annuity Value (AV), Internal Rate of Returns (IRR) and Pay-Back Period (PBP) as suggested by Gittinger (1972).

The Technology

(i) Natural protected pasture : Enclosure of the area by barbed wire fencing; grazing stopped for atleast two years; from the third year onwards, animals allowed to graze from September through June; no other measures or treatments.

(ii) Natural protected pasture with soil conservation measures : Technology at (i) above, supplemented by the use of a pitting disker to pulverise soil and enhance moisture conservation at the onset of monsoon.

(iii Sown pastures :

a. Land preparation : levelling, clearing of bushes and trash before onset of monsoon for proper soil working operations;

b. Soil working by one harrowing after first good showers;

c. Manual sowing of grass seed (5-6 kg/ha) on prepared and tractor furrowed land (furrow distance 50 cm);

d. In the first year of establishment, one hand weeding to reduce competition offered by weeds and to ensure proper fodder growth.

e. Second year of establishment and onwards, one interculture for soil working, weeding after first effective rains and fertilizers (N and P @ 20 kg/ha) as urea and single super phosphate drilled in between grass rows.

f. Forage harvested at 50 per cent flowering for seed collection, the forage harvested in December and January;

g. Seed collection done manually by stripping the spikes.

RESULTS AND DISCUSSION

Cost Structure

Total costs of improved pastures comprised capital costs including fencing, material costs included costs of seeds, manure and fertilizer and maintenance costs included cleaning of bushes, interculture, sowing, application of fertilizers, hoeing and weeding, collection of seed, harvesting of grasses, resowing of grasses and depreciation on fixed costs. In case of alternative systems, the total costs included only fencing, interculture by pitting disker and depreciation. The distribution of total costs accruing to the three pasture management systems was worked out with a 16 year planning horizon (Table 1).

Table 1. Cost structure for pasture management system for 16 years planning horizon in arid areas of western Rajasthan (Rs per 100 ha)

Costs	Natural pasture		Sown pastures		
	Protected	Protected with soil conservation	Only forage production	Forage + seed production	With grazing
Capital	60 000	60,000	60,000	60,000	60,000
	(71.42)	(36.58)	(5.12)	(3.18)	(6.28)
Material	—	—	6,49,600	6,49,600	6,49,600
			(55.43)	(34.33)	(67.96)
Maintenance	24.000	1,04,000	4,62,300	11,82,300	2,46,300
	(28 58)	(63.42)	(39.45)	(62.49)	(25.76)
Total	84,000	1,64,000	11,71,900	18,71,900	9,55,900

Note - Figures in parentheses indicate percentage of total costs

There was a sizeable escalation in total costs with increased level of technology adoption. In all improved pastures with alternative usage options, the cost increase ranged from 8 for natural to 18 times on sown pastures. With additional cost incurrences incidental to application of technology (for sown pasture), capital costs tended to decline proportionately. Further, material costs had highest relative shares for sown pastures meant for forage production and grazing of animals. On the other hand, maintenance costs claimed highest relative share of the total costs in case of sown pastures meant for seed and forage production.

Return Structure

The returns in the present context constituted returns from forage selling, seed and grazing charges accruable, from usage options on forage production systems on a 16 year planning horizon are set out in Table 2. Natural protected pastures gave the highest returns from cattle grazing followed by mixed and sheep grazing. The same pattern held good for natural protected pasture with soil conservation measures, but with returns higher (almost doubled in all grazing options) than the natural protected pasture. Twin objective of seed as well as forage had a definite edge over the grazing options alone in case of sown pastures. It is thus expected that on the test of economic viability, joint production of seed along with forage production may have an edge over the other pasture systems. Actually joint production of seed and forage option may have suitability on lands characterised by high livestock densities.

Economic viability of alternative pasture systems

Net present value (NPV), discounted gross benefit-cost ratios (DGB-C), Annuity (A), Internal rate of return (IRR) and pay-back period (PBP) were employed to test the alternative pasture systems for their economic viability (Table 3). Almost all pasture systems were endowed with positive NPV magnitudes. From amongst grazing options, cattle grazing was the most remunerative, followed by mixed grazing and sheep grazing. It is, however, noteworthy that from a mere Rs. 200 - 300 per ha per year of earning from grazing systems in natural protected pastures, application of soil conservation measures could result into more than three-folds increase in the NPV magnitudes. Similarly enhanced NPV magnitudes in seed and grass farming followed by forage selling were discernible for non-grazing options.

Discounted gross benefit-cost ratios testified that the pastures, irrespective of alternative systems, proved sufficiently productive. However, from grazing activities, returns ranged from 36 per cent for sheep to 51 per cent for cattle grazing. With the addition of soil conservation measures, the rate of returns ranged at the escalated levels of 79-99 per cent, respectively, for sheep and cattle grazing activities. In case of sown pastures, returns were lowest from grazing (2% for sheep grazing to 14% for cattle grazing). Sale of forage gave 79% returns and the returns from the seed + forage sale systems gave 191% returns. Grazing rates do not vary under different pasture systems and, as such, pastures for seed collection and sale of grass would be more remunerative activity against the options of grazing.

Addition of soil conservation measures increased the annuity for grazing system and ranged from Rs. 35 and Rs. 50 to Rs 118 and Rs. 147 per ha of land for sheep and cattle grazing, respectively on natural protected pastures. Annuities for grazing in sownpasture with improved technology ranged from Rs. 17 for sheep to Rs. 97 for cattle grazing at prevalent rates of grazing fee per animal. However, for seed-grass option,

Table - 2. Return structure for pasture management system for 16 years planning horizon in arid areas of western Rajasthan
(Rs per 100 ha)

Returns	Natural protected pasture			Natural protected pasture with soil conservation measures.			Sownpasture				
							Only forage production	*With forage + seed production	With grazing		
	Sheep	Cattle	Mixed	Sheep	Cattle	Mixed			Sheep	Cattle	Mixed
Forage	—	—	—	—	—	—	24,00,000	12,00,000 (20.00)	—	—	—
Seed	—	—	—	—	—	—		48,00,000 (80.00)	—	—	—
Grazing	2,52,000	2,80,000	2,68,800	5,04,000	5,60,000	5,37,600	—	—	11,52,000	12,80,000	12,16,000
TOTAL	2,52,000	2,80,000	2,68,800	5,04,000	5,60,000	5,37,600	24,00,000	60,00,000	11,52,000	12,80,000	12,16,000

*Figures in parentheses indicate percentage

the annuity from the same land could be around Rs 2500 00 per ha per year. Similarly, for forage selling it was Rs. 669.00 per ha annually.

Internal rate of return signifies the intrinsic economic worth of these alternative systems. From the estimates, it is clear that pasture systems, by and large, is remunerative and economically a worthwhile land use for marginal and sub-marginal lands in arid areas of western Rajasthan. For natural pastures, the IRR ranged between 20 for sheep grazing to 22 per cent for cattle grazing option. For grazing in pastures with soil conservations measures, the IRR ranged from 25 per cent for sheep grazing

Table 3. Economic evaluation of alternative pasture-system in arid areas of western Rajasthan (Rs per 100 ha)

Criteria of evalu..tion	Natural protected pastures	Naturral protected pastures with soil conservation mesaures	Sown pastures with improved grasses (forage)
Net present value (Rs.)			
Sheep	21,934 00	73,777 00	10,753.30
Cattle	31,176.00	92,261.00	60.889.30
Mixed	27,479 20	84,867 40	35,821.30
Forage and seed	—	—	4,14,974 80
Grass	—	—	15 43,035.00
Discounted benefit-cost-ratio			
Sheep	1.36	1.79	1.02
Cattle	1.51	1.99	1.14
Mixed	1.45	1.92	1.08
Forage and seed	—	—	1.79
Grass	—	—	2.91
Annuity (Rs.)			
Sheep	3,499.92	11,772.30	1,715.80
Cattle	4,974.63	14,721.72	9,715.80
Mixed	4,384.74	13,541.95	5,715.80
Forage and seed	—	—	66,215.86
Grass	—	—	2,46,215.89
Internal Rate of return (%)			
Sheep	20.40	25.60	16.00
Cattle	22 00	26.60	24.00
Mixed	21.40	26.00	21.00
Forage and seed	—	—	31.60
Grass	—	—	37.70
Pay back period)Years)			
Sheep	7	7	14
Cattle	7	7	12
Mixed	7	7	13
Forage and seed	—	—	8
Grass	—	—	5

to about 27 per cent for cattle grazing. These ranges, however, dropped to about 17 per cent for sheep and 24 per cent for cattle grazing under sown pasture production system. Under sown pastures, the best choice may thus rest with adoption of forage selling and of seed-grass farming systems in vicinity of heavy forage demand points for materialised realisation of IRR ranging form 31 to 37 per cent.

Pay-back periods of any enterprise determine the speed of recovery of cost flows for a given planning horizon. One of the most desirable elements of a project lies in it quick-pace of recovery. In present case, grazing systems for natural pasture irrespective of inter-species productivity variances, proved to be around seven years. This shows that natural pastures, with small modification in technology of pasture management, would be endowed with quicker pace of recovery. For sown pasture, this recovery would be commensurate if grazing activity is complimented adequately with seed-grass selling activity.

Conclusion and Policy implications

Arid lands of western Rajasthan qualify for allocation to pasture enterprise. All the hinterlands if enclosed, and with little soil conservation measures, can be made to produce enough fodder for livestock in desert. Wherever infrastructure, individual managerial attributes and proximity to high density livestock points permit, improved pastures with new technologies can be initiated. The initial costs for such an adoption may be high but economic returns alone would render this landuse system productive in the long run. Finally fodder production activities for selling, and seed-grass production from pasture lands could be restricted only to rural areas located near towns and markets. The differences between the pasture management systems on hinterlands and rural areas endowed with fortunate locations could only be mitigated if the two locations are linked under common goal of providing sufficient fodder for the livestock in desert without imparing prospects of rational resource-use in desertic areas.

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