Research Article

Production Potential and Economics of Different Cropping Systems Module for Different Farming Systems in Telangana

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Abstract

A field experiment was conducted at college farm, AICRP on Integrated Farming Systems unit, PJTSAU, Hyderabad to identify the production potential and economics of different cropping systems for different farming systems under irrigated situation in light textured soils of Southern Telangana Zone (STZ), Telangana. Treatments comprised of ten cropping systems grouped in to five sub sets, tested in Randomized Block Design (RBD) with three replications. Among the ten cropping systems tested, sweet corn – vegetable system (tomato) was found to be more remunerative with B:C ratio 3.48 followed by okra –marigold - beetroot system with B:C ratio 2.98. Among the ecological cropping systems for improving soil health, Bt cotton + greengram (1:3) - groundnut cropping system was recorded significantly higher rice grain equivalent yield (14,080 kg ha^{-1}) and net returns (1,57,471 Rs ha^{-1}) compared to pigeonpea + greengram (1:7) – sesame cropping system. Out of the two systems tested to meet the household nutritional security, pigeonpea + maize (1:3) – groundnut system recorded higher rice grain equivalent yield (13693 kg ha^{-1}) with higher net returns (148413 Rs ha^{-1}). Within the two fodder crops/cropping systems, fodder maize – lucerne system was resulted in higher B:C ratio (1.68). Rice - maize and Bt cotton which were the pre-dominant cropping systems of the region wherein rice – maize system recorded comparatively higher B:C ratio (1.55) than Bt cotton (1.51).

Keywords: Cropping systems, crop diversification, rice grain equivalent yield (RGEY), system productivity and system profitability

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Introduction

Development of efficient cropping systems, modification of crop micro environment and other support services are important adaptation strategies to minimize the impact of natural hazards on crop growth, stabilize the crop production and farm income. Cropping system in a region are decided, mostly by the type of soil and climatic parameters which determine overall agro-ecological setting for nourishment and appropriateness of a crop or set of crops for cultivation. Potential productivity and monetary benefit acts as a guidance principle while opting for particular crop or cropping system. Crop diversification is known to enhance profitability, reduce pests, spread out labour more uniformly, reduce risks from aberrant weather by different planting and harvesting time and source of high value products from new crops [1]. Crop diversification shows lot of promises like, fulfilling basic needs for cereals, pulses, oilseeds and vegetables and, regulating farm income, withstanding weather aberrations, ensuring balanced food supply, conserving natural resources, reducing the chemical fertilizer and pesticide loads, ensuring environmental safety and creating employment opportunity [2].

Reliance on biological nitrogen fixation through inclusion of legumes in a cropping system and maintenance of higher soil organic matter will help to built up soil fertility and better soil physical and microbial environment with good buffering capacity. Inclusion of legumes in cropping systems under intensification and interruptive approaches, as per resource availability, led to considerable improvement in productivity and profitability on the one hand and soil fertility, on the other hand [3]. At present, cultivars are heavy feeders resulting in an unfavourable effect on the sustainability of soil productivity. There is a pressing need to meet the varied food grain and other nutritional requirements of the growing population and to sustain a higher productivity level. Hence, there is an urgency to diversify present cropping pattern into new areas like vegetables, fodder, oilseeds, pulses and allied fields crops. Crop sequencing can also accentuate synergistic interactions among crops [4]. Hence, selection of component crops needs to be suitably planned to harvest the synergism among them towards efficient utilization of resource base and to increase overall productivity [5]. Rice, maize and Bt cotton are the predominant crops which are either grown solely

or in rotation with other crops in the Sothern Telangana Zone. As all are exhaustive, non–leguminous in nature cropping systems are to be identified to compliment the crops and to improve soil suitability in cropping system module. Several workers in the recent past reported that the productivity and income is far higher when integrated farming systems are practiced than crops alone [6-8]. In view of this farming system perspective, inclusion of ecological cropping systems, involving pulses / green manures and other crops for improving soil health, cropping system involving cereals / pulses / oilseeds to meet the household nutritional security, cropping system for round the year green / dry fodder production and cropping systems involving vegetables and other high value crops are to be studied for their productivity and sustainability.

Material and Methods

The study was conducted at college farm, All India Coordinated Research Project on Integrated Farming Systems unit, Professor Jayashankar Telangana Sate Agricultural University, Rajendranagar, Hyderabad during 2018-19. The treatments consisted of ten crop sequences. The experiment was laid out in RBD, replicated thrice and the site of the experimental field was same through out the experimentation. The varieties of different crops used were rice - RNR - 15048, groundnut – K 6, greengram- MGG 295, pigeonpea – PRG 176, sesamum- Swetha thil, finger millet – Hima, fodder sorghum – CSH 24 MF and fodder cowpea – Vijaya. Crops were raised under irrigated conditions with recommended package of practices of the region. The soil was sandy loam, low in organic carbon (0.39%), available nitrogen (112 kg ha^{-1}), medium in available phosphorus (23.4 kg ha^{-1}) and available potassium (170 kg ha^{-1}). In the context of identifying best crops and cropping systems that are suitable for farming systems of Southern Telangana Zone of Telangana state, various combination of crop sequences were studied. The ten combinations of cropping systems tested during *kharif*, *rabi* and summer seasons were grouped in to five subsets. They are pre-dominant cropping systems of the region (T_1 & T_2), T_1: rice - maize, T_2: Bt cotton alone, second sub set (T_3 and T_4) included ecological cropping systems involving pulses for improving soil health *viz*., T_3: Bt cotton + greengram (1:3) - groundnut, T_4: pigeonpea + greengram (1:6) - sesame, under cropping system involving cereals / pulses / oilseeds to meet the household nutritional security (T_5 & T_6) T_5 : pigeonpea + maize (1:3)-groundnut, T_6: pigeonpea + groundnut (1:7) - ragi, within cropping systems for round the year green / dry fodder production (T_7 & T_8) T_7: fodder sorghum + fodder cowpea (1:2) – horsegram - sunhemp, T_8: fodder maize - lucerne, under cropping systems involving vegetables and other high value crops for income enhancement (T_9 & T_{10}) T_9 : sweet corn -vegetables (tomato), T_{10}: okra – marigold – beetroot. All the *kharif* crops were sown on 04-07-2018 and the following sequence crops during *rabi* were taken up as and when the preceding *kharif* crops were harvested in the respective plots. Economic yield and stover/straw/stalk yields were recorded individually for all the crops in cropping systems. For comparison of different crop sequences, the yields of all the crops were converted in to rice grain equivalent yield on price basis. Crop yields were recorded at the end of each season and rice equivalent yield (REY) was computed at the end of the cropping system cycle. System yield was obtained by adding REY of component crops and system economics was calculated on the basis of prevailing cost of inputs and market price of the produce. The objective of the study was to work out a profitable and location specific cropping systems for different farming systems of Telangana, which can utilize resources judiciously to maximize return, protect the environment and meet the day-to-day nutritional requirements of human and livestock.

Results and Discussion

The performance of different high value crops in terms of rice grain equivalent yield during *kharif* indicated that sweet corn crop recorded significantly higher RGEY (10415 $kgha^{-1}$) over other field and vegetable crops evaluated in different cropping systems (**Table 1**). Sweet corn and okra were tested under cropping systems involving high value crops and sweet corn (10415 kg ha^{-1} and Rs.1,27,755 net returns) was found to be more remunerative than okra (7007 kg ha^{-1} with 79,806 Rs ha^{-1} net returns). Among the ecological cropping systems for improving soil health, Bt cotton + greengram (1:3) cropping system recorded significantly higher RGEY (7827 $kgha^{-1}$) and net returns (86,100 Rs ha^{-1}) than pigeon pea + greengram (1:3) (5492 kg ha^{-1} and Rs. 67,060 net returns) cropping system. Cotton hybrid - Bunny and variety - Narsimha intercropped with soybean recorded 28 and 29 per cent more seed cotton yield, respectively, over corresponding sole crops. Due to higher price of greengram, net returns from Bt cotton intercropped with greengram in 1:3 row ratio system were higher (Rs 48676 ha^{-1}) followed by Bt cotton intercropped with soybean at 1:3 row ratio (Rs 46345 ha^{-1}) and Bt cotton intercropped with greengram at 1:2 (Rs. 43425 ha^{-1}) [9]. Similar maximum net returns (Rs 61604) were observed in cotton + greengram intercropping than all other paired row cotton with intercrops [10]. Cereal - legume intercropping systems were superior to mono cropping [11].

Table 1 Performance of crops in various cropping systems during *kharif*

Treatments	Grain yield		Straw/ Stover yield		Productivity (Rice grain Equivalent Yield kg ha^{-1})			Profitability (Rs ha^{-1})			
	(kg ha^{-1})		(kg ha^{-1})		Grain	Straw	Total	Cost of cultivation (Rs. ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns Rs. ha^{-1}	Rs. Re^{-1}
A1 T1 Rice	5885	0	6884	0	5885	393	6278	46445	109872	63427	1.37
T2 Bt cotton	2084	0	4947	0	6490	71	6561	45820	114815	68995	1.51
A2 T1 Bt cotton + Greengram (1:3)	1971	384	4687	800	7669	158	7827	50875	136975	86100	1.69
T2 Pigeon pea + Greengram (1:3)	1104	440	3672	925	5334	158	5492	29050	96110	67060	2.31
A3 T1 Pigeon pea + Maize (1:3)	5642	445	7347	1532	6924	442	7366	53170	128904	75734	1.42
T2 Pigeon pea + Groundnut (1:7)	1178	1360	3944	2184	7621	431	8052	52100	140909	88809	1.70
A4 T1 Fodder sorghum + Fodder Cow pea (1:2)	0	0	13559	15690	0	4239	4239	27855	74187	46332	1.66
T2 Fodder maize	0	0	3934	90	0	4497	4497	25745	78697	52952	2.06
A5 T1 Sweet corn	16845	0	20431	0	8663	1751	10415	54500	182255	127755	2.34
T2 Bhendi	6111	0	1585	0	6984	23	7007	42810	122616	79806	1.86
S Em±							363				
CD (0.05)							1088				
CV (%)							9.8				

Sale price for Grain (kg^{-1}) : Rice = Rs 17.5, Maize = Rs 17.0, Groundnut = Rs 48.9, Bhendi = Rs 20.00, Bt Cotton = Rs 54.5, Greengram = Rs 69.75, Pigeonpea = Rs 56.75, Sweet corn = Rs 9.00
Sale price for stover (kg^{-1}) : Rice = Rs 1.00 Maize = Rs 1.00, Bhendi = Rs 0.25, Groundnut = 3.00, Greengram = Rs 2.00, Bt cotton = 0.25, Pigeonpea = Rs 0.25, Fodder sorghum = Rs 2.00, Fodder cowpea = 3.00, Fodder maize = 2.00

Legumes are widely recognized as builders of soil fertility and contribute substantial amounts of N for sustainability of cereal-based cropping systems. Inclusion of legumes increases soil fertility and consequently the productivity of succeeding cereal crops [12]. Out of the two systems tested to meet the household nutritional security, both pigeon pea + maize (1:3) (**Figure 1**) and pigeon pea + groundnut (1:7) systems were on par with each other and recorded almost similar rice grain equivalent yields of 7366 and 8052 kg ha^{-1} respectively. Out of the two fodder crops, fodder sorghum + fodder cow pea (1:2) (4239 kg ha^{-1}) and fodder maize (4497 kg ha^{-1}) systems were on par with each other. Rice and Bt cotton were tested as pre-dominant cropping systems of the region and recorded almost similar rice grain equivalent yields with 6278 and 6561 kg ha^{-1} respectively (**Figure 2**).

Figure 1 Pigeonpea (1) + maize (3) intercropping

Figure 2 Over all view of different cropping systems

The performance of different crops in terms of rice grain equivalent yield during *rabi* and *summer* indicated that marigold followed by beetroot crop (T_{10}) recorded significantly higher RGEY (29427 kg ha^{-1}) over other crops evaluated in different cropping systems (**Table 2**). Tomato and marigold followed by beetroot crops were tested under cropping systems involving vegetables and other high value crops for income enhancement and marigold followed by beetroot crop (T_{10}) (29427 $kgha^{-1}$ with 401979 $Rsha^{-1}$ net returns) was found to be more remunerative than tomato. Among the ecological cropping systems, groundnut crop recorded significantly higher RGEY (6253 $kgha^{-1}$) and net returns (71370 $Rsha^{-1}$) than sesame (2899 kg ha^{-1} with net returns of 26314 $Rsha^{-1}$. Out of the two systems tested to meet the household nutritional security, groundnut crop recorded significantly higher rice grain equivalent yield (6327 kg ha^{-1}) and net returns (72679 $Rsha^{-1}$) than ragi. Out of the two fodder crops, lucerne crop (3212 $kgha^{-1}$) resulted in comparatively higher rice grain equivalent yield over horsegram followed by sunhemp crops, though both the systems were on par with each other. Maize and fallow were tested as pre-dominant cropping systems of the region and recorded RGEY of 5493 $kgha^{-1}$ with net returns of 62,541 $Rsha^{-1}$.

Table 2 Performance of crops in various cropping systems during *rabi* and *summer*

Trt	Cropping sequence	Economic yield (kg ha^{-1})		Straw yield (kg ha^{-1})		Rice grain equivalent yield (kg ha^{-1})				
		Rabi	Summer	Rabi	Summer	Grain Rabi	Summer	Straw Rabi	Summer	Total
T1	Maize	5313		6907		5103		390		5493
T2	Fallow	0		0		0		0		0
T3	Groundnut	2016		2420		5570		684		6253
T4	Sesame	814		1799		2874		25		2899
T5	Groundnut	2040		2447		5636		691		6327
T6	Ragi	1912		4155		3129		59		3188
T7	Horsegram - Sunhemp	0		8406	17422	0		950	1476	2426
T8	Lucerne	0		28427		0		3212		3212
T9	Tomato	26667		5386		15066		76		15142
T10	Mariegold - Beetroot	12157	15375	6434	3168	20605	8686	91	45	29427
	CD (at 5%)									2579.0
	SEm ±									861.0
	CV (%)									19.0

Sale price for grain (kg^{-1}) : Maize = Rs 17.0, Rice = Rs 17.7, Tomato = Rs 10.0, Groundnut = Rs 48.9, Sesame = Rs 62.49 Fingermillet = Rs 28.97, Marigold = Rs 50.00, Beetroot = Rs 10.00.
Sale price for stover (kg^{-1}) : Maize = Rs 1.00, Rice = Rs 1.00, Tomato = Rs 0.25, Groundnut =Rs 5.00, Sesame =Rs 0.25, Fingermillet = Rs 0.25, Horsegram = Rs 2.0, Sunhemp = Rs1.5, Lucerne = Rs 2.0, Marigold = Rs 0.25, Beetroot = Rs 0.25

Table 3 Performance of crops in various cropping systems

Treatments		*Kharif* (2018)				*Rabi* (2018-19)		Summer (2018-19)		Rice Grain Equivalent Yield (kg ha^{-1})						Productivity			
Kharif-Rabi		**Grain yield (kg ha^{-1})**		**Straw/ Stover yield (kg ha^{-1})**		**Grain Yield**	**Straw/ Stalk/ Stover yield**	**Grain Yield**	**Stover yield**	***Kharif***		***Rabi***		**Summer**		**(RGEY kg ha^{-1})**			
		Main crop	**Inter crop**	**Main crop**	**Inter crop**	**(kg ha^{-1})**	**(kg ha^{-1})**	**(kg ha^{-1})**	**(kg ha^{-1})**	**Grain**	**Straw**	**Grain**	**Straw**	**Grain**	**Straw**	***Kharif***	***Rabi***	***Summer***	***System***
T1	Rice-Maize	5885	0	6884	0	5313	6907			5885	393	5103	390			6278	5493	0	11771
T2	Bt Cotton	2084	0	4947	0	0	0			6490	71	0	0			6561	0		6561
T3	Bt cotton+Greengram (1:3)-Groundnut	1971	384	4687	800	2016	2420			7669	158	5570	684			7827	6253	0	14080
T4	Pigeon pea + Green gram (1:6) - Sesame	1104	440	3672	925	814	1799			5334	158	2874	25			5492	2899	0	8391
T5	Pigeon pea+Maize (1:3)-Groundnut	5642	445	7347	1532	2040	2447			6924	442	5636	691			7366	6327	0	13693
T6	Pigeonpea + Groundnut (1:7) - Ragi	1178	1360	3944	2184	1912	4155			7621	431	3129	59			8052	3188	0	11240
T7	Fodder sorghum + Fodder cowpea (1:2) – Horsegram - Sunhemp	0	0	13559	15690	0	8406		17422	0	4239	0	950		1476	4239	950	1476	6666
T8	Fodder maize - Lucerne	0	0	39349	0	0	28427			0	4497	0	3212			4497	3212	0	7709
T9	Sweetcorn-Vegetables (Tomato)	16845	0	20431	0	26667	5386			8663	1751	15066	76			10415	15142	0	25557
T10	Okra – Marigold - Beetroot	6111	0	1585	0	12157	6434	15375	3168	6984	23	20605	91	8686	45	7007	20696	8731	36434
	S Em±															363	2579.0		
	CD (0.05)															1088	861.0		
	CV (%)															9.8	19.0		

Sale price for Grain (kg^{-1}) : Rice = Rs 17.7, Maize = Rs 17.0, Groundnut = Rs 48.9, Bhendi = Rs 20.00, Bt Cotton = Rs 54.5, Greengram = Rs 69.75, Pigeonpea = Rs 56.75, Sweet corn = Rs 9.0, Tomato = Rs 10.0, Sesame = Rs 62.49, Fingermillet = Rs 28.97, Marigold = Rs 50.00,
Beetroot = Rs 10.00.
Sale price for stover (kg^{-1}) : Rice = Rs 1.00 Maize = Rs 1.00, Bhendi = Rs 0.25, Groundnut = 5.00, Greengram = Rs 2.00, Bt cotton = 0.25, Pigeonpea = Rs 0.25, Fodder sorghum = Rs 2.00, Fodder cowpea = 3.00, Fodder maize = 2.00, Tomato = Rs 0.25 Sesame =Rs 0.25,
Fingermillet = Rs 0.25, Horsegram = Rs 2.0, Sunhemp = Rs1.5, Lucerne = Rs 2.0, Marigold = Rs 0.25, Beetroot = Rs 0.25.

Regarding system productivity, okra–marigold–beetroot system recorded significantly higher RGEY (36434 kg ha^{-1}) over other crops evaluated in different cropping systems. However, due to high cost of cultivation in okra–marigold–beetroot system, sweet corn – vegetables (tomato) system recorded higher profitability (3.48 B:C ratio) compared to all other cropping systems (**Table 3**). Among the ecological cropping systems, Bt cotton + greengram (1:3)- groundnut cropping system recorded significantly higher rice grain equivalent yield (14080 $kgha^{-1}$) and net returns (157471 Rs ha^{-1}) than pigeon pea + greengram (1:6) - sesame (8391 kg ha^{-1}) cropping system. In two year cotton – legume - corn rotation, an yield increase to the tune of 11 per cent was recorded as compared to continuous cotton grown without legumes [13]. Six Bt cotton based double cropping systems *viz*., two millets, two pulses and two oilseed crops were evaluated to identify the most profitable, productive and sustainable system. Amongst them, Bt cotton - maize recorded the highest seed cotton equivalent yield [10].

Out of the two systems tested to meet the household nutritional security, maize + pigeonpea (1:3) – groundnut system recorded higher rice grain equivalent yield (13693 $kgha^{-1}$) with high net returns (148413 Rs ha^{-1}) over pigeonpea + groundnut (1:7) - ragi system (**Figure 3**). The grain yield of maize increased from 3.9 t ha^{-1} to 4.4 t ha^{-1} with increasing succession of groundnut crop in sequence [14]. Out of the two fodder crops/cropping systems, fodder maize – lucerne (1.3) system resulted in higher RGEY (7709 $kgha^{-1}$) and net returns (84939 Rs ha^{-1}) than fodder sorghum + fodder cowpea (1:2) - horsegram –sunhemp system (6666 kg ha^{-1}). Fodder or green manure legumes are more important N economizers than grain legumes [15]. Rice and Bt cotton were tested as pre-dominant cropping systems of the region and rice – maize system recorded higher RGEY (11771 $kgha^{-1}$) and net returns (125968 Rs ha^{-1}) than Bt cotton alone (6561 $kgha^{-1}$). Among the cropping systems involving vegetables and other high value crops for income enhancement, sweet corn – vegetables (tomato) system was found to be more remunerative (25,557 $kgha^{-1}$ with 3,49,814 Rs ha^{-1} net returns and 3.48 B:C ratio) **(Table 4)** than okra–marigold–beetroot system. Intensification through inclusion of vegetables and leguminous crops increase the production and land use efficiency [16]. Similarly, inclusion of oilseed and vegetable crops changes the economics of a cropping system because of their higher market price, in addition to nutritional security [17].

Figure 3 Pigeonpea (1) + groundnut (7) cropping system

Table 4 Economics of crops in various cropping systems

Treatment		*Kharif*				*Rabi*				Summer				System	
Kharif-Rabi		**Cost of cultivation (Rs. ha^{-1})**	**Gross returns (Rs. ha^{-1})**	**Net returns**		**Cost of culti vation (Rs. ha^{-1})**	**Gross Returns (Rs. ha^{-1})**	**Net returns**		**Cost of cultiv ation**	**Gross returns**	**Net returns**		**Net returns**	
				Rs. ha^{-1}	**Rs. Re^{-1}**			**Rs ha^{-1}**	**Rs. Re^{-1}**	**Rs ha^{-1}**	**Rs. ha^{-1}**	**Rs. ha^{-1}**	**Rs. Re^{-1}**	**Rs ha^{-1}**	**Rs Re^{-1}**
T1	Rice-Maize	46445	109872	63427	1.37	34687	97228	62541	1.80	0	0	0	0	125968	1.55
T2	Bt Cotton	45820	114815	68995	1.51	0	0	0	0.00	0	0	0	0	68995	1.51
T3	Bt cotton +Green gram (1:3)- Ground nut	50875	136975	86100	1.69	39312	110682	71370	1.82	0	0	0	0	157471	1.75
T4	Pigeon pea + Green gram (1:6) - Sesame	29050	96110	67060	2.31	25003	51317	26314	1.05	0	0	0	0	93374	1.73
T5	Pigeon pea+ Maize (1:3)-Ground nut	53170	128904	75734	1.42	39312	111991	72679	1.85	0	0	0	0	148413	1.60
T6	Pigeonpea + Ground nut (1:7) - Ragi	52100	140909	88809	1.70	24006	56429	32424	1.35	0	0	0	0	121233	1.59
T7	Fodder sorghum + Fodder cowpea (1:2) – Horse gram - Sunhemp	27855	74187	46332	1.66	14647	16812	2165	0.14	11987	26133	14146	1.18	62643	1.15
T8	Fodder maize - Lucerne	25745	78697	52952	2.06	24868	56854	31986	1.29	0	0	0	0	84939	1.68
T9	Sweetcorn-Vegetables (Tomato)	54500	182255	127755	2.34	45957	268017	222059	4.83	0	0	0	0	349814	3.48
T10	Okra – Marigold - Beetroot	42810	122616	79806	1.86	75168	366318,	291150	3.87	43713	154542	110829	2.53	481785	2.98

Sale price for Grain (kg^{-1}) : Rice = Rs 17.7, Maize = Rs 17.0, Groundnut = Rs 48.9, Bhendi = Rs 20.00, Bt Cotton = Rs 54.5, Greengram = Rs 69.75, Pigeonpea = Rs 56.75, Sweet corn = Rs 9.0, Tomato = Rs 10.0, Sesame = Rs 62.49, Fingermillet = Rs 28.97, Marigold = Rs 50.00, Beetroot = Rs 10.00.
Sale price for stover (kg^{-1}) : Rice = Rs 1.00 Maize = Rs 1.00, Bhendi = Rs 0.25, Groundnut = 5.00, Greengram = Rs 2.00, Bt cotton = 0.25, Pigeonpea = Rs 0.25, Fodder sorghum = Rs 2.00, Fodder cowpea = 3.00, Fodder maize = 2.00, Tomato = Rs 0.25 Sesame =Rs 0.25, Fingermillet = Rs 0.25, Horsegram = Rs 2.0, Sunhemp = Rs1.5, Lucerne = Rs 2.0, Marigold = Rs 0.25, Beetroot = Rs 0.25.

Conclusion

Under high value crops, sweet corn - tomato was more remunerative followed by okra – marigold - beetroot system. Among the ecological cropping systems, Bt cotton + greengram (1:3) – groundnut, under the cropping systems for household nutritional security, pigeonpea + maize (1:3) - groundnut system, under two fodder crops/cropping systems, fodder maize – lucerne system and under pre-dominant cropping systems, rice – maize systems were most profitable and can be suggested for different farming systems of Southern Telangana Zone of Telangana under irrigated dry situation.

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