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PRODUCTION POTENTIAL AND ECONOMIC VIABILITY OF FOOD–FORAGE BASED CROPPING SYSTEMS IN SOUTHERN TELANGANA REGION OF ANDHRA PRADESH

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SUMMARY

A field experiment was conducted to evaluate the forage production potential of various intensive cropping systems including speciality corn types for both food and forage. NB hybrid+cowpea–Lucerne was found most efficient cropping system in terms of green and dry fodder yields and for year round forage production. But under peri urban situations, Maize+cowpea–Maize-Maize+cowpea systems were found to be more efficient in terms of net returns (Rs.1,19,200/yr), FEY(278 t/ha/yr) and MUE(326.5 Rs/ha/day).

Key words : kd

In peri-urban areas, the availability of land for agriculture is restricted due to urbanization and increased demand of land for housing. Crop intensification either in space or in time or both is the feasible option left to the farmers for enhancing the production. Food – forage based systems provide a support to small and marginal farmers by adjusting a substantial part of their land exclusively for forage production in grain crop based rotations (Sunil kumar and Faruqui, 2009). Efficient crop sequence in intensive agriculture promotes productivity per unit area per unit time and provides more economic benefits to the farmers. In rice based cropped area of A.P, pillipesara and sun hemp are grown as fodder crops on residual moisture after rice harvest (Hazra, 1998). In this agro climatic region of Andhra Pradesh, high yielding quality forage crops can be introduced in the existing cropping systems to meet the forage demand. Short duration forage crops like cowpea, guar and sorghum offers scope to grow in *kharif* season followed by food based *rabi* crops.

Maize is an ideal forage crop, possessing quick growing and high yielding ability during summer season and can be fed to the cattle at any stage of growth, as there is no problem of hydrocyanic acid or oxalic acid poisoning to cattle. Raising of baby corn and sweet corn both for food and forage can be encouraged in peri-urban areas for their demand through out the year. NB hybrid + cowpea – berseem and maize – berseem-cowpea are the profitable intensive forage based cropping systems to Andhra Pradesh (Suneetha Devi *et al*., 2004).

Hence, to evaluate intensive forage based cropping systems involving speciality corn types in peri-urban areas, in Southern Telangana region of Andhra Pradesh, this study was under taken.

MATERIALS AND METHODS

A field experiment was conducted for three years (2007 to 2009) at LRI, Rajendranagar, Hyderabad. The soil was sandy loam, low in organic carbon (0.32%), available nitrogen (87.7 Kg ha $^{-1}$) high in available phosphorus (68.8 kg ha $^{-1}$) and medium in available potassium (230.2 kg ha $^{-1}$). A total rainfall of 588.8mm, 1167.9mm and 663.2mm was received in 48, 51 and 38 rainy days during the three years of study, respectively. The treatments consisted of ten crop sequences viz., C1- NB hybrid + cowpea- Lucerne, (round the year forage crop rotation of the region) C2- Baby corn + cowpea-baby corn- Baby corn +cowpea, C3- Baby corn + cowpea – Lucerne (best food crop rotations of the region), C4- Baby corn + cowpea-Oats - Baby corn + cowpea, C5- Baby corn+ cowpea- Oats –Fodder maize+ cowpea(inclusion of rabi crop in the rotation), C6- Green cob + cowpea- green cob - Green cob + cowpea, C7- Green cob + cowpea – Lucerne, C8- Green cob + cowpea- Oats – Green cob + cowpea, C9- Green cob + cowpea- Oats – Fodder maize + cowpea, C10- Maize(G) + cowpea- Lucerne(F)– Lucerne(s)(best remunerative

rotation of the zone). The experiment was laid out in RBD with three replications and the site of the experimental field was same through out the experimentation. The varieties of different crops used were NB hybrid- APBN-1, baby corn – G-5406, green cob- Madhuri, fodder maize- African tall, cowpea – COFC-8, Lucerne- Anand-2, Oat – OS-6 and grain maize- DHM-111.

Sowing of *kharif*, *rabi* and summer crops was done during the I FN of July, I FN of November and I FN of March, respectively. Crops were raised under irrigated conditions with recommended package of practices of the region. Stem cuttings of NB hybrid 'APBN-1' were planted in July at a spacing of 90 x 60 cm and the crop was maintained as perennial stand. Cowpea during *kharif* and Lucerne during *rabi* were planted as intercrop in between two wider rows of NB hybrid. Cowpea was sown as an intercrop in maize during *kharif* and summer seasons under additive series. All the forage crops were harvested at 50% flowering stage. Baby corn and green cobs were harvested at soft dough stage as cobs. Lucerne sown during *rabi* was harvested for green fodder up to two cuts and thereafter, left for seed purpose. In NB hybrid, after first cut, interval for subsequent cuts was 45 days. Data on growth and yield was taken at appropriate harvesting schedules of the crops. Economics and NB hybrid forage equivalent yield were computed at prevailing market prices. Production efficiency was worked out by dividing the total production of a sequence by total duration of the crops in that sequence (Tomar and Tiwari, 1990). The data was pooled over three years and given as mean pooled data. Sustainability yield index was computed for the sequences on the basis of NB hybrid equivalent yield.

RESULTS AND DISCUSSION

Crop Productivity

Production potential of component crops of all the cropping sequences showed variation over three years. Higher green fodder yield was recorded with C1 (NB hybrid+ cowpea – Lucerne) in all the three years of experimentation (Table-1). It may be due to the high production potential of NB hybrid as reported earlier by Patel et al., (2003). Green fodder yield of NB hybrid was low during *rabi* season over other seasons. This clearly indicates the winter dormancy character in NB hybrid and the number of cuttings were hence, reduced. Islam and Thakuria (2002) also reported winter dormancy in NB hybrid during *rabi* season and therefore inclusion of legume as inter crop in the existing NB hybrid will supplement green fodder yield and compensate the yield loss due to less number of cuttings of NB hybrid. Lucerne as intercrop supplemented green fodder yield of NB hybrid during *rabi* season in C1 cropping sequence. Cropping systems viz., C5, C9, C4 and C8 ranked as next best cropping systems in terms of GFY. In these cropping systems, Oats, which has high green fodder production potential was included as winter cereal crop during *rabi* season (Shashikala *et al*., 2009). However, the green fodder yield was very low with C3, C10 and C7 where Lucerne was included in the system during *rabi* season as the green fodder potential of Lucerne is low when compared to either NB hybrid or Oats. In these three systems Lucerne seed could also be harvested, besides green fodder (Table-2). In general, during *kharif* season green fodder yields were low with the cropping systems where speciality maize types were grown. C2 and C6 systems recorded about 529 and 626 q/ha(Table-1) of green fodder, respectively. In these two

TABLE 1

Season-wise Green Fodder Yield (q/ha) of entire sequence grown for baby corn and sweet corn

Cropping system	2007-08				2008-09				2009-10				Mean			
	kharif	**rabi**	Summer	Total	**kharif**	**rabi**	Summer	Total	**kharif**	**rabi**	Summer	Total	**kharif**	**rabi**	Summer	Total
C1	603	362	1073	2038	419	437	595	1451	401	448	1023	1872	474	416	897	1787
C2	249	159	223	631	139	148	199	486	150	155	165	470	179	154	196	529
C3	284	242	0.00	526	165	137	0.0	302	151	132	0.0	283	200	170	0.0	370
C4	270	357	247	874	150	328	224	702	157	367	185	709	192	351	219	762
C5	259	288	244	791	158	318	264	740	153	385	279	817	190	330	262	782
C6	267	237	256	760	150	243	240	633	136	170	179	485	184	217	225	626
C7	259	237	0.00	496	146	140	0.0	286	151	110	0.0	261	185	162	0.0	347
C8	261	346	285	892	140	277	262	679	134	333	219	686	178	319	255	752
C9	253	313	248	814	115	313	304	732	173	340	282	795	180	322	278	780
C10	100	182	0.00	282	137	134	0.0	271	179	120	0.0	299	139	145	0.0	284

systems, speciality maize types were included in all the three seasons. Though the green fodder yield was comparatively low, green cobs could be obtained besides green fodder, which will be more remunerative in peri urban situations.

Cob yield of maize was higher with C2 and C6 sequences (Table-2), where in maize was included in all the three seasons of the cropping system. This may be due to another fact that about 4 to 5 pickings were obtained from baby corn. This was followed by C4 (96 q/ha), where baby corn was raised during *kharif* and summer seasons. The highest dry fodder yield (366q/ ha) was obtained with C1(Table-2) and this may be due to the high green fodder production potential of NB hybrid and higher dry matter content. C9 &C5 were the next best sequences with regard to dry fodder yield (152 and 151 q/ha, respectively).

Higher crude protein yield (Table-2) was obtained with C1 (16.71 q/ha). Though the crude protein content of NB hybrid was low, due to the higher dry fodder yield, CPY was found to be higher. The cropping systems involving Lucerne – a legume (C3, C7 and C10) recorded higher CPY (7.64, 7.84 and 6.81 q/ha, respectively) due to higher CP contents even though the dry fodder yields are low.

System Productivity

Pooled data indicated variation in system productivity in terms of Forage Equivalent Yield of food – forage and forage based cropping systems (Table-3). Among all the tested systems, Baby corn + cowpea – baby corn - Baby corn + cowpea produced highest FEY (277.7t/ha/yr) and it was 25.3% higher over C4 (221.6t/ ha/yr), where oat was included in the system during *rabi* season instead of baby corn. C6 recorded a FEY of 196.1 t/ha/yr and it was comparable with C9 where, maize (either baby corn or sweet corn) was a component crop of the system. Inclusion of Oats as *rabi* crop was found better in terms of FEY over Lucerne (C3, C7 and C10). Higher FEY of maize might be due to the monetary benefit through cob yield besides green fodder yield. The lower FEY was obtained with C10 and it might be due to the lower green fodder yield of Lucerne. Though, there was an additional advantage of seed yield of Lucerne in this sequence, the seed yield of Lucerne was meager so that it could not compensate with the monetary benefit of cob yield of maize. Sunil kumar and Faruqui, (2009) also reported higher FEY of the cropping systems where maize was included. Similar trend was observed with system productivity also. C2 sequence recorded higher system productivity (0.76t/ ha/day) followed by C4 (0.61t/ha/day) and it might be due to the higher net returns of those systems (Table-3). Higher system productivity was observed with maize based food forage cropping systems over others and this may be due to the higher monetary benefit from maize. Suneetha Devi *et al*., (2004) also reported higher system productivity of maize – Lucerne (F)- Lucerne(s) cropping system. Higher sustainability yield index (SYI) was recorded(0.82) with Baby corn + cowpea – baby corn - Baby corn + cowpea system indicating its stability over three years followed by Baby corn + cowpea-Oats -Baby corn + cowpea(0.62).

Economics

Economics of various food forage based cropping systems showed variation in terms of monetary benefit (Table-3). Baby corn+cowpea–baby corn-Baby corn+cowpea showed maximum net returns (Rs. 119200 / ha/yr) and the next best cropping system was C4, where

TABLE 2

Important yield parameters of food–forage based cropping systems (Mean of 3 years)

Cropping systems	Cob yield (q/ha)	Dry Fodder Yield (q/ha)	Crude protein yield (q/ha)	Seed yield of lucerne (q/ha)
C1-NB hybrid+cowpea-Lucerne	0.0	366	16.71	-
C2-Baby corn+cowpea-baby corn-Baby corn+cowpea	151	91	4.05	-
C3-Baby corn+cowpea–Lucerne	60	140	7.64	2.05
C4-Baby corn+cowpea-Oats-Baby corn+cowpea	96	135	5.13	-
C5-Baby corn+cowpea- Oats–Fodder maize+ cowpea	52	151	5.66	-
C6-Green cob+cowpea-greencob-Green cob+cowpea	148	114	5.17	-
C7-Green cob+cowpea-Lucerne	46	139	7.84	1.88
C8-Green cob+cowpea-Oats–Green cob+cowpea	89	142	5.46	-
C9-Green cob+cowpea-Oats–Fodder maize+cowpea	41	152	5.26	-
C10- Maize(G)+cowpea-Lucerne (F)–Lucerne (s)	35	135	6.81	1.98

TABLE 3
Forage equivalent yield, economics and system productivity of food – forage based cropping systems
(mean of 3 years)

Cropping systems	Forage equivalent yield (t/ha)	System productivity (t/ha/day)	Net returns x 103 Rs./ha/yr	B : C ratio	Monetary return use efficiency (Rs./ha/day)	Sustainability yield index
C1- NB hybrid+cowpea-Lucerne	176.6	0.48	93.6	5.54	256.4	0.46
C2- Baby corn+cowpea-baby corn-Baby corn +cowpea	277.7	0.76	119.2	2.94	326.5	0.82
C3- Baby corn+cowpea–Lucerne	179.3	0.49	81.5	3.28	223.2	0.47
C4- Baby corn+cowpea-Oats-Baby corn+cowpea	221.6	0.61	96.6	3.11	264.6	0.62
C5- Baby corn+cowpea-Oats–Fodder maize+ cowpea	159.6	0.44	59.4	2.46	162.7	0.40
C6- Green cob+cowpea-green cob - Green cob+cowpea	196.1	0.54	68.2	2.18	186.8	0.53
C7- Green cob+cowpea-Lucerne	121.8	0.33	43.9	2.56	120.2	0.26
C8- Green cob+cowpea-Oats–Green cob+cowpea	154.6	0.42	52.7	2.32	144.4	0.38
C9- Green cob+cowpea- Oats–Fodder maize+cowpea	187.8	0.51	77.6	2.82	212.6	0.50
C10- Maize(G)+cowpea-Lucerne(F)–Lucerne(s)	99.0	0.27	31.2	2.37	85.5	0.18
S Em+	25.22	0.069			33.71	
C. D. (P=0.05)	74.92	0.205			75.52	

Market Rate (Rs.): 1) Maize baby corn (with husk): 10/- per Kg 2) Maize green cob: 06/- per Kg.
3) All fodder: 650/- per ton 4) Lucerne seed: 150/- per Kg.

oats was included as a *rabi* crop, which is also having higher production potential of green forage. Lowest net returns were obtained with C10 [Maize(G) + cowpea – Lucerne(F)- Lucerne(s)] as the green fodder potential of Lucerne is low and the seed yield of Lucerne is very meager to compensate over maize. C1 system also recorded 93,600 Rs/ha/yr indicating the superiority of NB hybrid production potential over other crops. Where as Benefit-cost ratio was highest (5.54) with C1(5.54) followed by C3 (3.28) and C4(3.11). It might be due to the lower cost of cultivation involved for NB hybrid due to its perennial nature. Though the net returns of C2 were highest, B-C ratio was 2.94 only and it might be due to the higher cost of production involved in pickings of baby corn through out the year. Patel *et al*., 2003 also reported higher net returns with Hybrid Napier + cowpea – Lucerne system. The monetary return use efficiency (Table-3) was highest with C2 (326.5 Rs/ha/day) followed by C4 (264.6Rs/ha/day) and C1 (256.4 Rs/ha/day). Lowest MUE (85.5 Rs/ha/day) was recorded with Maize (grain) + cowpea – Lucerne (F) - Lucerne(s). Similar results were also reported earlier by Sunil Kumar and Faruqui, (2009).

Thus it can be concluded that in this agro – climatic zone, NB hybrid + cowpea – Lucerne was found most efficient cropping system in terms of green and dry fodder yields and for year round forage production. But under peri urban situations, Maize + cowpea – Maize - Maize + cowpea systems were found to be more efficient in terms of net returns, FEY and MUE. Integration of forages in food based production systems may prove sustainable and economically viable, which not only provide food but also supports live stock by supplying green fodder.

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