WEATHER REPORT

The highest maximum temperature of 34.7^{0}C was recorded on 28th Jul'11 while the lowest minimum temperature of 5.1^{0}C was recorded on 21st Dec'11. The mean monthly maximum and minimum air temperatures were found to vary from 20.9^{0}C to 31.1^{0}C and 9.7^{0}C to 24.9^{0}C, respectively. Jan 2012 was the coolest month and Aug 2011 was the hottest month. The average monthly maximum and minimum relative humidity varied from 74.6% to 85.4% and 6.5 % to 64.7%, respectively. The total rainfall received during the year 2011-12 (Apr '11 to Mar '12) was 1641.40 mm and the total rainy days were 121. The monthly rainfall was the maximum in Jun'11 (474.2 mm). No rainfall occurred during Nov and Dec'11. Except during Oct'11 to Mar '12 when the sky was clear. The average monthly wind speed varied from 0.26 kmph (Jul '11) to 27.31 kmph (Apr '11). Apr and May were observed to have high wind velocity. Soil temperatures were recorded both in the morning and evening at 5 cm, 15 cm and 20 cm depths. The soil temperature showed a decreasing trend along the soil depth. Total monthly evaporation was found to vary from 39.9 mm (Jan '12) to 101.8 mm (Apr '11). Weather data are presented in Table1

Table 1 Average monthly weather data of Nagaland for the period from Apr '11 to Mar '12 (mean values are given in parentheses with bold letters)

Air temperature (^{0}C)		**Relative humidity (%)**		**Pan evaporation (mm)**	**Total rainfall (mm)**	**Soil temperature (^{0}C) (5 cm)**		**Soil temperature (^{0}C) (15 cm)**		**Soil temperature (^{0}C) (20 cm)**	
Max	**Min**	**Max**	**Min**			**Max**	**Min**	**Max**	**Min**	**Max**	**Min**
20.9 (Jan'12) – 31.1 (Aug'11) **(28.35)**	9.7 (Feb'12) – 24.9 (July'11) **(18.21)**	74.6 (Feb'12) – 85.4(Aug'11) **(80.18)**	6.5 (Feb'12) – 64.7 (July'11) **(40.83)**	39.9 (Jan'12) – 101.8 (April'11) **(917.1)**	**1641.4**	11.4 (Jan'12) – 23.9 (Oct'11) **(19.92)**	3.9 (Jan'12) – 17.2 (July'11) **(11.8)**	21.4 (Jan'12) – 33.5(Oct'11) **(29.68)**	14.9 (Jan'12) – 27.8 (Sept'11) **(22.65)**	19.7 (Jan'12) – 34.7 (June'11) **(28.83)**	15.5 (Jan'12) – 27.9 (July'11) **(23.10)**

CROP SCIENCE

RICE

RCRT trials

Thirty paddy lines were tested under lowland. The highest yield was recorded in the line 1-149 (6.34 t/ha).The other lines that gave higher yields than control Ranjit (4.68 t/ha) were 1-417 (5.43 t/ha), 1-302 (5.10 t/ha) and 1-308 (4.79t/ha).

In another trial 13 lowland paddy varieties were evaluated. Among them IET-16313 recorded the highest yield (5.56 t/h) followed by IET-18572 (5.23 t/ha).

Effects of crop establishment methods and fertility levels on growth, yield and quality of rice in rice-lentil cropping system

A field experiment was carried out during the *kharif* season of 2011-12. The soil of the experimental site was slightly clay loam, acidic in reaction (pH=5.2), high in organic carbon (1.13%), low in available nitrogen (239.20 kg/ha), potash (127.31 kg/ha) and moderate in phosphorous (15.78 kg/ha). The experiment was laid out in split-plot design (SPD) with three replications. Three crop establishment methods *viz.*, system of rice intensification (SRI), integrated crop management (ICM) and conventional rice culture (CRC) were allotted to the main plot. Five treatments of fertility level, i.e. control, 100% RDF, 100 % RDF + crop residues, 100 % RDF ON and 100 % RDF ON + crop residues were allotted to the sub-plots; where ON represents organic nitrogen (120 kg/ha) through farm yard manure. The results (Table 2) revealed that in crop establishment methods, SRI recorded significantly the highest yield attributes and yield followed by ICM, and CRC recorded significantly the lowest yield attributes and yield of the crop. In case of fertility levels, the treatment 100 % RDF + crop residues recorded significantly the highest yield attributes and yield followed by 100 % RDF, 100 % RDF ON + crop residues as compared to control. It was due to better integrated nutrient management that helped the crop for sound growth and development.

Table 2 Effect of crop establishment methods and fertility levels on yield attributes yield of rice in rice-lentil cropping system

Treatments	**Panicle length (cm)**	**Grains/ panicle (no.)**	**Grain yield (t /ha)**	**Straw yield (t/ha)**	**Biological yield (t /ha)**	**Harvest index (%)**
Crop establishment methods						
SRI	27.3	523.1	3.65	3.21	6.86	53.21
ICM	26.2	492.8	3.40	3.20	6.60	51.52
CRC	24.6	356.7	2.90	2.57	5.57	52.10
SEm	0.42	23.22	0.16	0.27	0.40	2.16
CD (*P*=0.05)	1.63	91.16	0.64	1.05	1.56	8.47
Fertility level						
Control	24.1	402.0	2.41	2.18	4.59	52.51
100 % RDF	28.0	489.6	3.55	3.23	6.78	56.4
100 % RDF + crop residues	29.0	518.6	3.70	2.99	6.69	55.3

100 % RDF ON	25.5	435.0	2.57	2.30	4.87	52.77
100 % RDF ON + crop residues	24.5	405.8	2.52	2.41	4.93	51.11
SEm	0.55	22.81	0.16	0.20	0.25	2.56
CD (*P*=0.05)	1.60	66.57	0.47	0.59	0.74	7.48

Validation of indigenous technical knowledge for weed management for sustainable production of *jhum* rice

The field experiment was initiated in the farmers' *jhum* field of Medziphema village, Nagaland in the beginning of the Jan, 2012. The treatments were 10 different doses of common salt (20, 40, 60, 80, 100, 120, 140, 160, 180, and 200 kg/ha) at 20 and 40 DAS, weedy check and control (weedy) in randomized complete block design with three replications. The experimental site was situated at an elevation of 309 m above mean sea level having 25°45'43''N latitude and 93°53'04"E longitude. The climate of the experimental site is sub-tropical, exhibiting high humidity and medium to high rainfall. In Jan 2012, the jungle was cleared. Before cutting the forest, soil samples were collected for analysis. In end of Mar, the jungle cuttings were burnt and soil samples were collected and analysed (Table 3) to evaluate the post burning effect.

Table 3 Soil characteristics of the project site

Stage	**p^H**	**EC (ds/m)**	**OC (%)**	**Avail. N (kg/ ha)**	**Avail. P (kg/ ha)**	**Avail. K (kg/ ha)**
Before cutting	4.73	0.0596	1.02	84.67	8.23	46.75
After cutting	4.19	0.0556	0.783	137.98	8.99	91.88
After burning	5.81	0.415	1.04	166.21	9.80	290.96

MAIZE

Effect of mulching, liming and INM on *rabi* maize var. DA-61-A under rainfed condition

A field experiment was carried *rabi* season with maize var.DA61A (Fig 1). The soil of the experimental site was slightly clay loam, acidic in reaction (p^H=5.3), high in organic carbon (1.02 %), low in available nitrogen (219.20 kg/ha), potash (123.31 kg/ha) and moderate in phosphorous (12.78 kg/ha). The experiment was laid out SPD with three replications. The main plots were control and mulch, and the sub-plot treatments were with

Fig 1 *Rabi* maize var. DA-61-A

farm yard manure (FYM) having four levels (control, 4, 8 and 12 t/ha), and in the sub-sub plots, four levels of liming (control, 0.2, 0.4 and 0.6 t/ha). The results showed (Table 4) that liming recorded significantly higher yield attributes and yield. The increased levels of FYM increased the yield attributes and yield. Similar trends were observed for FYM.

Table 4 Effect of mulching, liming and INM on *rabi* rainfed maize var. DA61A

Treatments	Cob/plant (no.)	Grains/row (no.)	Cob length (cm)	Rows/cob (no.)	Grain yield (t /ha)	Harvest index (%)
Mulching						
Control	1.06	25.07	11.09	11.68	1.92	49.61
Mulch	1.26	31.77	17.82	14.03	2.53	50
SEM	0.03	1.57	0.97	0.46	0.19	0.63
CD (*P*=0.05)	0.11	6.78	4.21	2.01	0.45	NS
Farm yard manure (t/ha)						
4	1.04	25.83	11.95	11.54	2.08	47.33
8	1.19	29.39	14.58	12.78	2.26	50.04
12	1.33	30.03	16.83	14.25	2.33	52.04
SEM	0.03	1.72	1.23	0.94	0.11	0.52
CD (*P*=0.05)	0.08	3.5	2.5	1.92	0.25	1.2
Liming (t/ha)						
Control	1.11	24.16	11.83	11.44	1.85	48.33
0.2	1.18	26.78	14.48	12.8	2.21	48.77
0.4	1.18	30.7	14.7	12.96	2.23	50.44
0.6	1.23	32.04	16.8	14.23	2.61	51.66
SEM	0.01	0.75	0.57	0.43	0.11	0.51
CD (*P*=0.05)	0.06	3.26	2.45	1.85	0.23	1.05

MUSTARD

Response of fertility levels on Indian mustard [*Brassica juncea* (L.) Czern and Coss.] under rainfed condition

Experiment was carried out during *rabi* season . The soil of the experimental site was slightly clay loam, acidic (pH=5.4), high in organic carbon (0.87%), low in available nitrogen (226.20 kg/ha), potash (120.78 kg/ha) and moderate in phosphorous (11.04 kg/ha). There were four fertility levels (control, 100% RDF, 125% RDF and 150% RDF, where RDF was 60: 40: 40: 30 kg/ha of N:P:K:S) in the main plots and three varieties (M27, TS38 and TS36) in the sub-plots treatment (Fig 2). The maximum values of all the growth parameters were recorded with 150% (grain yield=0.85 t/ha) recommended dose of fertilizer followed by 125% RDF (grain yield=0.74 t/ha) and 100% RDF (grain yield=0.71 t/ha). Among the different varieties, TS38 recorded the higher values of growth and yield attributes *viz*., plant height, leaves/plant, no. of branches/plant that were at par with TS36 in all stages of growth. Different varieties also

Fig 2 Toria crop at flowering stage

showed significant variation in the attributes of siliquae/ plant, siliqua length and seed/siliqua. The highest yield was recorded by the variety TS38 (0.89 t/ha) followed by TS36 (0.76 t/ha) and M27 (0.72 t/ha).

LINSEED

Effect of fertility levels and seeding rate on linseed under rainfed condition

Experiment was carried out during *rabi* season of 20011-12. The treatment was comprised of 12 combinations: four levels of fertility *viz*., control F_0 (NPKS zero), F_1 (20 kg N, 10 kg P, 10 kg K and 10 kg S), F_2 (40 kg N, 20 kg P, 20 kg K and 20 kg S), F_3 (60 kg N, 30 kg P, 30 kg K and 30 kg S) ha^{-1} and three seed rates, S_1 (20 kg), S_2 (30 kg), S_3 (40 kg) ha^{-1}. Each treatment was replicated thrice in factorial RBD. The increase in fertility levels from F_0 to F_3 significantly increased all the growth attributes at various growth stages. Increase in the fertility levels from F_0 to F_3 resulted in the increase in the entire yield attributes *viz.*, number of capsule/plant and number of seeds/capsule. Increase in the fertility levels resulted in increase in seed and straw yields. The increase in seed rate resulted in decrease in plant height, number of branches/plant, number of capsules/plant, and number of seeds/capsule. The increase in seed rate significantly increased the grain yield from 20 kg to 30 kg/ha; however, further increase in seed rate decreased the grain yield (Table 5).

Table 5 Effect of different fertility levels on growth, yield attributes on linseed

Treatments	Plant height (cm)	Pri. branch /plant (no.)	Sec. branch/ plant (no.)	Capsules/plant (no.)	Seeds/ capsules (no.)	Capsules yield /plant (g)	Seeds/plant (no.)	Seed yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)
	At 90 DAS	At 90 DAS	At 90 DAS							
Fertility levels*										
F_0	75.34	8.77	69.34	107.27	7.49	12.74	355.75	0.35	0.55	0.90
F_1	77.82	7.33	79.82	116.89	8.59	14.91	550.56	0.36	0.60	0.96
F_2	78.89	6.33	80.89	137.14	8.68	15.91	590.80	0.38	0.67	1.05
F_3	79.87	6.96	82.87	366.67	8.65	17.31	644.55	0.40	0.79	1.19
Seed rates*										
S_1	72.63	7.80	72.63	145.39	10.38	17.13	591.38	0.30	0.65	0.95
S_2	79.56	6.89	78.56	136.84	8.79	16.15	489.85	0.32	0.60	0.92
S_3	85.25	6.75	89.25	127.42	8.68	15.49	488.89	0.31	0.68	0.99

*F_0: Control, F_1: 20-10-10-10: NPKS kg/ha, F_2: 40-20-20-20:NPKS kg/ha, F_3: 60-30-30-30: NPKS kg/ha, S_2: 30 kg/ha, S_3: 40 kg/ha

RICE BEAN

Effect of levels of lime application on growth, yield and quality of rice bean

This field experiment was carried out during the *kharif* season of 2011-12. The soil of the experimental site was slightly clay loam, acidic in reaction (p^H=5.4), high in organic carbon (1.03 %), low in available nitrogen (229.20 kg/ha), potash (137.31 kg/ha) and moderate in phosphorous (11.78 kg/ha). The experiment was laid out SPD with three replications. Four levels of lime, *viz.*, control (no application), 0.2, 0.4 and 0.6 t/ha were allotted to the main plots where, four varieties of rice bean such as RBS16, RBS53, PRR2 and RCRB4 were allotted to the sub-plots. Results showed that the increased levels of lime increased the yield of the rice bean varieties. Lime application @ 0.6 t/ha recorded significantly higher yield attributes and yield followed by 0.4 and 0.2 t/ha. In case of the varieties, RBS53 recorded significantly higher yield attributes and yield crop as compared to the other varieties (Table 6). The rice bean variety PRR2 recorded significantly lower yield attributes and yield as compared to the other varieties, which might be due to the lower yield potential of this variety.

Fig 3 Rice bean at flowering stage

Table 6 Effect of different levels of lime application on yield attributes and yield of ricebean cultivars

Treatments	Pod length (cm)	1000-seed weight (g)	Pods/plant (no.)	Seeds/plant (no.)	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t /ha)	Harvest index (%)
Lime application (q/ha)								
Control	6.45	66.17	24.67	88.18	0.40	0.49	0.89	47.38
0.2	6.68	66.58	31.36	72.68	0.55	0.59	1.14	46.95
0. 4	6.54	68.42	35.50	101.54	0.93	0.90	1.83	49.67
0. 6	6.97	69.08	33.63	106.55	0.84	0.82	1.65	52.42
SEm±	0.13	2.56	2.06	7.02	0.02	0.04	0.05	3.86
CD(*P* =0.05)	0.43	NS	7.13	24.28	0.06	0.15	0.17	NS
Varieties								
RBS16	6.57	67.08	25.28	82.15	0.65	0.67	1.32	46.51
RBS53	6.86	68.33	27.06	81.22	0.88	0.86	1.74	49.36
PRR2	6.81	67.42	42.84	102.33	0.41	0.43	0.84	50.22
RCRB4	6.39	67.42	29.97	103.25	0.78	0.84	1.62	50.33
SEm±	0.18	2.00	1.74	5.70	0.04	0.04	0.06	3.02

CD (*P* = 0.05)	NS	NS	5.09	16.65	0.12	0.10	0.19	NS

MUNGBEAN

Effect of date of sowing, seeding rate and INM on summer mungbean var. TS21

This field experiment was carried out during the *kharif* season. The soil of the experimental site was slightly clay loam, acidic in reaction (p^H=5.3), high in organic carbon (1.02 %), low in available nitrogen (219.20 kg/ha), potash (123.31 kg/ha) and moderate in phosphorous (12.78 kg/ha). The experiment was laid out in SPD with three replications with mungbean var.TS21 (Fig 4). Two dates of sowing *viz.* 5th and 15th April were allotted to the main plots and four seeding rates of 20, 25, 30 and 35 kg/ha was given in the sub-plots. The fertility levels were allotted in the sub-sub plots to evaluate their best applicability. The results revealed that 5th April sowing recorded significantly the highest yield attributes and yield of the crop. In case of seeding rate, increased levels of seeding rate increased the yield; but reverse in case of the yield attributes. The maximum yield was recorded with the highest seed rate due to a higher plant population. In case of fertility level, 100% IN + 50 % ON recorded significantly the highest yield attributes and the highest yield (Table 7).

Fig 4 Mungbean at pod formation stage

Table 7 Effect of sowing date, seed rate and INM on summer mungbean var. TS21

Treatments	Pod plant	Pod weight /plant (g)	Seed weight /plant (g)	Seeds/ pod (No.)	1000-seed weight (g)	Seed yield (t/ha)	Straw yield (t/ha)
Sowing date							
5th April	33.59	57.97	24.29	12.32	36.38	1.221	1.548
15th April	30.94	53.82	21.87	10.79	35.34	0.977	1.479
SEm	0.48	0.66	0.41	0.15	0.72	0.34	0.20
CD (*P*=0.05)	2.94	4.03	2.52	0.89	4.37	2.07	1.22
Seed rate (kg/ha)							
20	33.72	58.53	22.81	11.78	35.26	0.958	1.477
25	31.52	56.83	21.60	12.09	35.23	0.964	1.480
30	29.82	54.29	19.56	12.12	36.36	1.001	1.521
35	28.99	52.93	19.35	12.22	36.60	1.094	1.577

SEm	0.34	0.64	0.24	0.16	0.43	0.19	0.15
CD(*P*=0.05)	1.05	1.96	0.73	0.49	1.34	0.58	0.47
Fertility levels							
Control	28.32	54.64	20.47	11.75	34.09	0.870	1.411
100 % IN	31.55	57.83	23.25	12.30	35.31	1.050	1.607
100% IN+ 50% ON	33.92	59.22	24.52	13.11	36.19	1.128	1.523
S Em	0.37	0.53	0.21	0.12	0.38	0.18	0.18
CD (*P*=0.05)	1.06	1.54	0.62	0.35	1.10	0.51	0.51
RDF: 20-40-20 NPK kg/ha and IN : Inorganic nitrogen, ON: organic nitrogen through vermicompost							

PEA

INM in dwarf pea var. Azad

Experiment was carried out during *rabi s*eason with pea var. Azad (Fig 5). The soil of the experimental site was slightly clay loam, acidic in reaction (pH=5.3), high in organic carbon (1.03%), low in available nitrogen (229.20 kg/ha), potash (118.31 kg/ha) and moderate in phosphorous (12.78 kg/ha). The experiment was laid out in split- plot design with three replications. Five fertility levels (Table 2) *viz.,* control, 100% IN, 100% ON, 100% IN + 50% ON and 100% ON + 50% IN were allotted to the main plot where, IN represents recommended dose of N, P, K and S (40–20–20 –20 kg/ ha) through inorganic fertilizers and ON represents recommended dose of N (40 kg/ha) through vermicompost. Four treatments of biofertilizer (Rhizobium + PSB + PGPR) and micronutrient (Zinc) *viz.* control, biofertilizer, zinc and biofertilizer + zinc were allotted to the sub-plots. Results showed that superimposition of 50% N organic (recommended dose of N through vermicompost) to 100% NPK (recommended dose of NPK through fertilizers) resulted in increase in all the growth, yield parameters *viz.,* plant height, no of branches dry matter/ plant, pods/plant, and seeds/pod and yields (grain and straw). The same fertility level significantly out yielded the other treatments in case of number of pod/ plant whereas, closer to 100% ON + 50% IN and 100% IN in number of grains/ pod. Grain and straw yields increased with the increasing fertility levels and the maximum value was recorded with the application of 100% IN + 50% ON. Seed inoculations with biofertilizer and application of micronutrient (zinc) recorded higher values for grain and straw yields over the control (Table 8).

Fig 5 Pea var. Azad at flowering stage

Table 8 Effect of INM on growth, yield attributes and yields of dwarf pea

Treatment	Plant height (cm)			Pri. branch /plant (no.)		Dry matter /plant (g) at harvest	Pods/ plant (no.)	Seeds/ pod (no.)	Seed yield (t/ha)	Straw yield (t/ha)
	30 DAS	60 DS	90 DAS	60 DS	90 DAS					
Main plots (Fertility levels)										
M_0	11.63	26.32	36.05	8.43	13	213.33	2.67	5.67	0.19	0.37
M_1	12.21	26.47	38.31	9	13.72	278.75	3.47	6.89	0.26	0.52
M_2	11.83	22.65	37.43	8.83	10.31	272.92	2.84	6.44	0.21	0.48
M_3	12.78	27.49	38.99	9.14	13.08	399.59	3.3	6.73	0.33	0.72
M_4	12.47	31.05	45.48	9.22	13.33	311.67	3.72	6.6	0.30	0.57
Sub plots (Biofertilizer + micronutrient)										
S_0	11.7	26.18	37.66	8.91	13.31	277.67	3.05	6.43	0.26	0.51
S_1	12.37	27.17	39.73	9.11	13.04	296.67	3.1	6.23	0.25	0.52
S_2	12.21	25.74	39.33	8.97	13.51	289	3.19	6.64	0.27	0.54
S_3	12.46	28.6	40.29	8.71	13.55	317.67	3.45	6.4	0.29	0.59

Main plots (Fertility levels): M_0: Control, M_1: 100% NPK, M_2: 100% $N_{organic}$, M_3: 100% NPK + 50% $N_{organic}$, M_4: 100% $N_{organic}$ + 50% NPK; Sub plots (Biofertilizers+micronutrients): S_0: Control, S_1: Biofertilizers, S_2: Zn @ 5 kg/ha, S_3: Biofertilizers + Zn.

HORTICULTURE

LILIUM

Evaluation of lilium cultivars

Six varieties (Fig 6) of Lilium, *viz.*, Sulpice, Brunello, Barasso, Acauplco, Lamacha, and Carmina were evaluated at a spacing of 30 cm × 30 cm under shade net house. The experiment was laid out in RBD design with four replications. Significant differences were observed for days taken for bud emergence, plant height, number of leaves, number of buds and days taken for flowering. Among the varieties days taken for bud emergence were earlier in Brunello (27.85 days) followed by Barasso (43.50 days). The highest plant height was recorded in Barasso (68.75 cm) while lowest in Lamacha variety (42.60 cm). The number of leaves was the maximum in Brunello (81.80) and minimum in Lamacha (28.00). The number of buds was the highest in Brunello (3.80) while minimum in Barasso (1.80). Days taken for bud emergence were earlier in Acaulpco (75.15 days) while late in Carmina (118.45 days)

Fig 6 Liliun under shed net house

Vase life study in Lilium

The effect of holding solution (3% sucrose + 2ppm 8-HQ) and control (distilled water) on the vase life of the flowers of six vars. *viz*., Sulpice, Brunello, Barasso, Acauplco, Lamacha and Carmina at room temperature was studied (Fig 7). The experiment was laid out in Factorial CRD with three replications. The flowers were harvested with stalk length of 45 cm at colour development stage of the first flower bud. The freshly harvested buds were kept in the solution. Significant variation was observed among the varieties for the post harvest characters of cut flowers. The highest length and diameter of the flower bud was recorded in Lamacha while, lowest in Brunello variety. The maximum diameter of stem was observed in Barasso (0.67 cm) and minimum in Brunello (0.50 cm). The diameter of the flower was the maximum in Lamacha (26.53 cm) and minimum in Brunello (21.55 cm). The days taken for bud burst and for full bloom were recorded the maximum in Barasso while, minimum in Brunello (2.37 days). The minimum number days taken for full bloom was observed in Sulpice (3.75 days) and Brunello (3.75 days). The vase life of flowers was recorded the maximum in Barasso (14.27 days) and the minimum in Lamacha (8.87 days).

Fig 7 Vase life studies in Lilium

ANTHURIUM

Evaluation of Anthurium cultivars

Seven varieties of Anthurium *viz.,* Violet Heart, L'Amour, Queen Black, First Red, Cynthia, Anastacia and Red were evaluated at a spacing of 30 cm × 30 cm under shade net house. The experiment was laid out in RBD design with three replications. The observations on plant height and number of leaves were recorded at three months after planting. Among the varieties evaluated, the maximum plant height was recorded in L'Amour (20.67 cm) and Queen Black (20.67 cm) while the minimum in Anastacia variety (15.67 cm). The number of leaves was the maximum in Cynthia (7.67) and the minimum in First Red (4.67) and Anastacia (4.67).

ORCHIDS

Evaluation of different tropical orchids

Six genera *viz*., *Mokara, Aranthera, Vanda, Oincidium* and *Dendrobium* were planted in pots in shade net house. Observations taken on plant height at three months after planting showed increased plant heights in all the genera.

COLOCASIA

Collection, characterization and conservation of indigenous landraces of colocasia

Twenty-five cultivars of colocasia collected from different districts of Nagaland and adjoining Assam were planted. The experiment was laid out in RBD with three replications. The results revealed that there was no significant difference in the no. of days taken for germination. All the lines germinated within 11 to 16 days after planting in the field. The maximum plant height was recorded in line 18 (113.96 cm), and the minimum in line 6 (54.44 cm). The maximum plant span of 130.0 cm was recorded in the line 7 while the minimum in line 3 (63.28 cm). The maximum number of suckers was recorded in the line 6 (6.0) and minimum in line 9 (0.71). The maximum number of leaves (28.28) was recorded in the line 2 and minimum of 5 leaves was recorded in the line 7. The maximum leaf length (60.11 cm) and leaf width (49.83 cm) was recorded in the line 1 and minimum leaf length of 24.50 cm and width of 21.17 cm was recorded in the line 2. The highest petiole length of 101.72 cm was recorded in the line 10 and the line 7 recorded the lowest petiole length (39.14 cm). There was significant difference in the no. of cormels among the lines evaluated.The highest no. of cormels was recorded by the line 21 (14.25) closely followed by the line 23 (14.0). The lowest no. of cormels was recorded in the line 5 (1.50) closely followed by the line 7 (2.0). The maximum corm weight (715.83 g) was recorded in the line 4, and the minimum (64.50 g) in the line 5. The highest cormel weight (275.00 g) was recorded in the line 1, and the lowest (20.77 g) in the line 13. There was wide variation in the total corm weight. The maximum total corm weight of 1329.20 g was recorded in the line 18, and the minimum of 108.24 g was recorded in the line 5. The vast variations in the yield characters were observed among the colocasia lines evaluated. This was due to the genetic characters of the plant, climatic conditions prevalent in the particular locality and nutrient status of the soils. The pest and disease occurrence and soil moisture also influenced the growth and development of the plant.

RAJMA BEAN

Collection, characterization and conservation of *rajma* beans

Extensive survey was conducted to identify the different *rajma* bean accessions in Nagaland and 39 different accessions were collected.

TECHNOLOGY MISSION (MM-1)

Propagation of quality seed and planting materials

During 2011-12, *khasi* mandarin seedlings (1000 nos.), Assam lemon cuttings (7050 nos.), black pepper cuttings (1050 nos.), and 100 kg of French bean seeds were produced in the Institute Research Farm and distributed to the farmers.

Table 9 Transfer of technology under Technology Mission (MM-1)

Topic of the training/demonstration	Number
Training on floriculture and landscaping for entrepreneurship development.	1
North-East Horti Farmers' Meet	1
FLD on rejuvenation of *khasi* mandarin	4
FLD on improved production technology of *khasi* mandarin	4
FLD on improved production technology of Assam lemon	4

Fig 8 Training on floriculture and landscaping

Fig 9 North-East Horti Farmers' Meet

SOIL HEALTH MANAGEMENT

Soil and water conservation

Site-specific low-cost water harvesting structures (*viz.*, *Jalkund*, base flow harvesting, rooftop rainwater harvesting, fish ponds, and Modified Thai Jar (for kitchen gardening) and soil erosion control measures (*viz.*, contour and graded bunding, bench terracing, half-moon terracing, gully plugging, and trenching) were carried out in Dimapur, Peren, Wokha, Kohima, Phek and

Fig 10 Diversion of irrigation channel under NICRA at Dhanshirpar village, Dimapur dist.

Mon districts of Nagaland for life saving irrigation, *in-situ* soil and moisture conservation. The works were undertaken under various projects, such as, Development of Non-forest Wastelands through Agro-forestry Models in Nagaland State of NEH Region, Integrated Watershed Development for Livelihood Security and Natural Resources Management, Livelihood Improvement and Empowerment of Rural Poor through Sustainable Farming Systems in Mon District of Nagaland, Horticulture Technology Mission, and National Initiative on Climate Resilient Agriculture.

AGROFORESTRY

Evaluation of growth performance of *Jatropha curcas*

A total of 11 provenances were screen for the growth performance of *Jatropha curcas*. Among them 'Molvum' genotype showed the highest seed oil (38.99%) followed by the genotypes viz., *Rangapahar* (37.51%) and *Piphema* (35.62%). *Molvum* source exhibited the highest growth rate in terms of height, followed by *Piphema*, and *Rangapahar* seed source had the lowest growth. The diameter growth was recorded highest in *Piphema* provenance, followed by *Rűzaphema*. Similar to the growth in height, no. of branches per plant were the highest in *Molvum* (12.5 nos. /plant), followed by *Dhansiripar* (10 nos./plant). The crop productivity was significantly low in the under storey plots of *Jatropha* mainly due to heavy shade and competition for light, soil moisture and nutrients between woody perennial and annuals. Hence, intercropping is not suggested with *Jatropha*.

Analyses of soil and plant samples from different districts of Nagaland

Soil samples (2244 nos.) of seven districts *viz.,* Dimapur, Peren, Kohima, Wokha, Mon, Tuensang and Phek were analyzed for N, P, K, organic carbon (OC), and pH. The ranges of average N, P, K, OC and pH of all those soil samples were 62.72-2025.86 kg/ha, 3.42-24.73 kg/ha, 20.27-519.57 kg/ha, 0.07-6.62%, and 4.72-5.80, respectively.

Effect of elevated temperature on soil carbon sequestration, microbial biomass and enzymatic activities under different land use

Soil samples from different land use pattern *viz.,* mustard-rice-maize, linseed- rice, green gram- groundnut- toria, lemon orchard (5 years old), linseed-rice-field pea (zero tillage), *jhum* land, terraced rice, agroforestry and non cultivated pasture land were collected and initial nutrient status was analyzed. The samples were saturated at field capacity and transferred into a moisture proof container and kept in a BOD incubator at 42°C for 1 month. Nutrient analysis data of initial and elevated temperature treated soil samples revealed (Table 10) that all the parameters show increasing trend due to heat treatment which might be due to

the combined effect of heat induced mineralization of organic sources as well as cellular materials of psychrophilic and mesophilic organisms.

Table 10 Nutrient analysis for initial and elevated temperature treated soil samples

Parameters	Initial		42°C treated	
	Range	Mean	Range	Mean
pH (1:2.5 Soil: water suspension)	4.28-5.92	4.86	4.59-5.88	5.09
EC (dS/m)	0.023-0.180	0.071	0.043-0.391	0.140
Oxidizable organic carbon (%)	0.22-1.22	0.56	0.27-1.19	0.58
Mieralizable N (kg/ha)	75.3-194.4	110.8	106.6-294.8	147.4
Available P (kg/ha)	41.5-380.9	122.9	46.5-365.8	129.2
Available K (kg/ha)	47.4-448.1	166.9	75.3-448.1	180.5

Model farming systems for resilient shifting cultivation

Since the existing shifting cultivation practices in eastern and northeastern India are the injudicious form of land use system, this study has been initiated to standardize different improved shifting cultivation based farming system models for Nagaland. Three systems *viz.*, agri-silvi-livestock, agri-horti-silvi and traditional *jhum* were tested. Generally, *jhum* caused the large-scale deforestation, soil and nutrient loss and loss of soil and forest biodiversity which lead to the environment and ecology degradation. The preliminary soil test data showed that oxidizable organic carbon, available-K, mineralizable nitrogen, pH increased after burning in the *jhum* area.

ANIMAL PRODUCTION

Mega Seed Project on Pig

Parent stock of Large Black and Ghungroo breeds of pigs are being reared under the project. A total of 623 numbers of piglets were born, of which 293 piglets were distributed to 95 farmers of Dimapur, Kohima, Wokha, Phek and Mon districts of Nagaland. Eighty three piglets were distributed to the farmers through four KVKs *viz.*, Dimapur, Phek, Wokha and Zunheboto and 58 piglets were also distributed to the beneficiaries under different projects at institute level. Altogether 434 piglets were distributed during the reporting year. The feedback from all the corners of the state is very much encouraging and demand of piglets produced under the project is enormous. During the reporting year a sum of Rs. 9,04,660 (Rupees nine lakh four thousand six hundred and sixty only) were generated as revenue under the project by selling the piglets and culled animals for meat purpose.

Establishment of pig breeding unit at farmers' field

The farmers of Nagaland are more interested on rearing pigs for fattening purpose. However, to meet the demand of quality piglets in every corner of the state, a total of six pig breeding units were established at the farmers' field in participatory mode in Dimapur, Kohima, Wokha and Mokokchung districts of Nagaland during the reporting year. Germplasm were supplied from the stock produced under Mega Seed Project on Pig and the performance evaluation of the breeding stock is under progress.

Fig 11 Pig breeding unit at Bade village (Dimapur district) and Mezoma village (Kohima

Comparative studies on productive and reproductive performances of different breeds of pig

The growth and reproductive performance of 25 gilts of Large Black cross and Ghungroo were monitored. The average daily weight gain was recorded as 176.67 g and 144.26 g during pre-weaning period and 361.73 g and 284.53 g during post-weaning period in Large Black and Ghungroo, respectively. At the pre-weaning period the body weight in Large Black cross piglet was found to be significantly higher as compared to Ghungroo pig; and during the post-weaning period, the body weight was similar up to six months. However, during the 7th month, the body weight was significantly higher in large Black cross than Ghungroo.

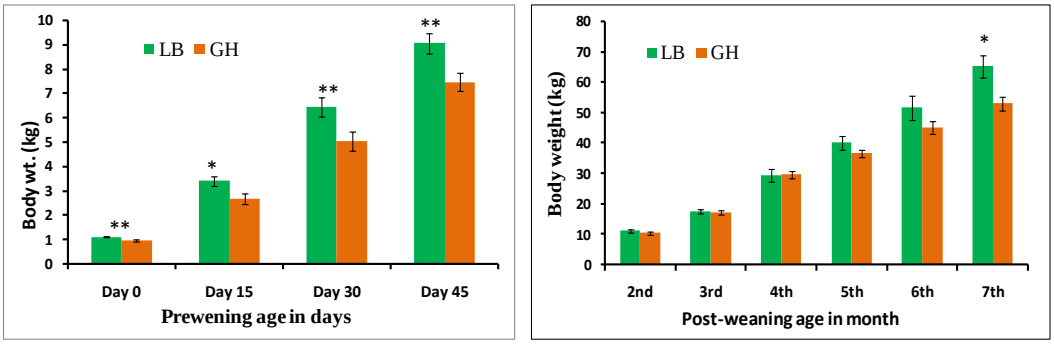

Fig 12 Pre-weaning and post-weaning growth performance of Large Black and Ghungroo Gilts under identical management condition in Nagaland (p<0.01, *

The reproductive performance of Large Black cross and Ghungroo pig was compared at the first parity and the parameters *viz.*, age at first estrus, age at conception, gestation period,

weaning to estrus interval, and litter size at birth and weaning were monitored. The results revealed that the Large Black cross and Ghungroo pigs were performing similarly under identical management condition in Nagaland.

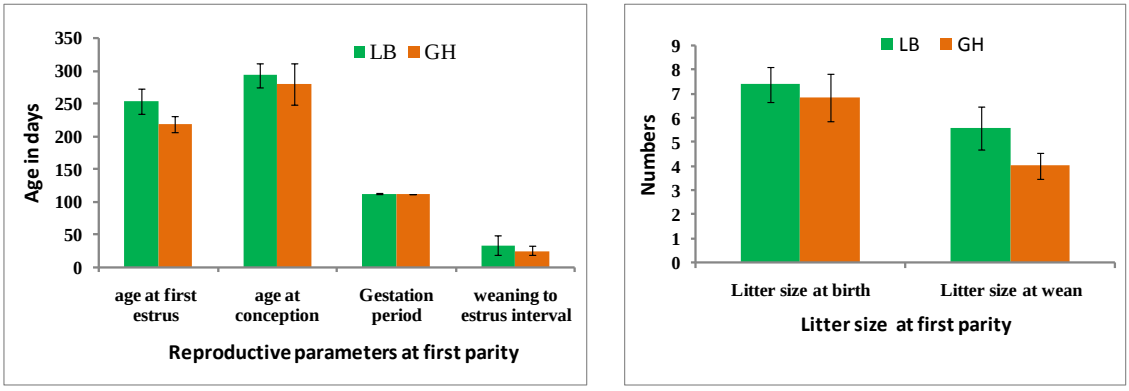

Fig 13 Reproductive performance of Large Black and Ghungroo Gilts at first parity under identical management condition in Nagaland

Poultry seed project

The parent stock of Vanaraja and Gramapriya chicken were maintained in this project. During the reporting year, three new poultry units comprising of hatchery house, brooder - cum- grower house and layer house were constructed. A total 79,089 eggs were produced of which 60,257 were set into hatchery unit and 38,401 chicks were produced with 82.85% fertility and 75.75% hatchability on the fertile eggs set. The chicks were reared for 3-4 weeks at the brooding unit and distributed to the beneficiaries at subsidized rate. A total of 26,177 day-old chicks were distributed to the beneficiaries of different districts of Nagaland and Arunachal Pradesh (Table 11). A sum of Rs. 12,15,058 (Rupees twelve lakh fifteen thousand and fifty eight) was realized as revenue by selling of chicks, eggs and culled birds.

Table 11Beneficiaries of the Poultry seed project

Particulars	**Total nos.**
No. of benefited farmers	16899 (196 farmers in 7 districts)
Distribution through KVKs	5168 (8 KVKs in 8 districts)
Distribution under the project NICRA/TSP/PD_ADMAS/NAIP etc.	4110 (4 districts)
Total no. of chicks distributed	26177

TRIBAL SUB-PLAN (TSP)

Seed production program for rice, maize, toria and linseed

Under the TSP, quality seed production program of *rabi* maize, linseed, and toria was initiated both in the farmers' field (in Vade village, Dimapur district) and in the Institute Research Farm during 2011-12. The total area selected for cultivation of *rabi* maize (rainfed condition) was about 2.0 ha. A total of 1.2 t of quality seeds of maize (*var.* RCM75 and RCM76) were produced to partially meet the huge demand of maize growing farmers. Quality seeds of toria var. TS36 and TS38, and linseed *var.* Garima and Neelam were also produced at ICAR Research Farm in an area of about 0.5 ha. The productivities of maize (var. RCM76), rapeseed (vars. TS36 and TS36), and linseed (var. Parvati) were 2.1 t/ha, 1.0 t/ha, 1.2 t/ha, and 0.8 t/ha, respectively

Under the TSP of Poultry Seed Project, 10 demonstration units for backyard poultry farming were established in farmers' field in a participatory mode in Dimapur, Wokha, Mokokchung and Phek districts of Nagaland. Each unit has the capacity to rear 400 numbers of birds under semi-intensive system. The evaluation and documentation of the performances of Vanaraja and Gramapriya in field condition is in progress.

Fig 14 Distribution of chicks by Shri Pangny Phom, Parliamentary Secy., Govt. of Nagaland to the farmers for demonstration of backyard poultry farming in Longleng

Implementation of Tribal Sub Plan under PD_ADMAS in Nagaland

Under TSP component of PD_ADMAS funded project, animal health coverage was extended in Bade and Diezephe villages of Dimapur district and Longsa village of Wokha district. Complete health coverage was given to all the livestock including poultry and dog by organizing six numbers of animal health camps, regular follow up program, routine deworming, and distribution of feed supplementation for animals. Prophylactic measure was taken up against the prevalent diseases of livestock, namely, FMD in cattle and goat, CSF in pig, Rabies in dog and Ranikhet, and IBD in poultry.

Animal health coverage was given to approx. 300 households comprising of 317 cattle, 761 pigs, 235 goats, 316 dogs and 4697 poultry birds. In addition to complete health coverage, about 1200 chicken were distributed to 90 beneficiaries of poor and marginal farming

community. After the follow up treatment, the impact of the project was assessed and documentation is in progress

Fig 15 Animal health camp and training cum-workshop program organized at Bade village, Dimapur and Longsa village, Wokha district under Tribal Sub Plan of PD_ADMAS

NICRA

CROP SCIENCE

Production potential of rainfed maize cultivars under moisture stress condition for climate resilient agriculture

This field experiment was initiated in the Institute Research Farm under the project 'National Initiative on Climate Resilient Agriculture (NICRA) on the theme "Identification of temperature (drought/ /high temp.) tolerant rice and maize varieties for northeastern hill ecosystem during the *rabi* season of 2011-12 under rainfed condition. The allocated treatments were: fertility levels with the recommended dose of fertilizer of N, P, K (80–60–40 kg/ha) through inorganic fertilizers (urea, DAP and MOP). This treatment was undertaken to evaluate the farmers' practices in relation to the natural resources management condition under climate change scenarios. The other treatments were: FYM which was applied as basal application @10 t/ha for improving the physico-chemical and biological properties of the soil. However, lime @0.5 t/ha was also applied as one of the treatment for reclamation of the soil acidity for better soil-reaction and crop health. Mulching was done to minimize the soil moisture loss from the experimental plot and also to improve the water productivity. Five maize varieties *viz*., Nagaland local, Vijay composite, DA-61-A, DHM-117 and RCM-75 were grown to evaluate their best suitability under moisture stress condition during the *rabi* season (rainfed condition). The results revealed that the growth and developmental parameter treatment RDF+FYM+lime+mulch recorded the highest growth and developmental parameters such as plant height, no of leaves, stem girth and dry matter accumulation, root length, root volume and CGR as compared to other treatments with the variety RCM-75. This

was due to the combined effect of the treatment which minimized the soil moisture loss and acidity and provided better soil health in relation to physical, chemical and biological properties of the soil; and also due to the genetic potential of the varieties under given condition of the environment. This conclusion is based on the one year data, which needs to be replicated to draw a valid conclusion.

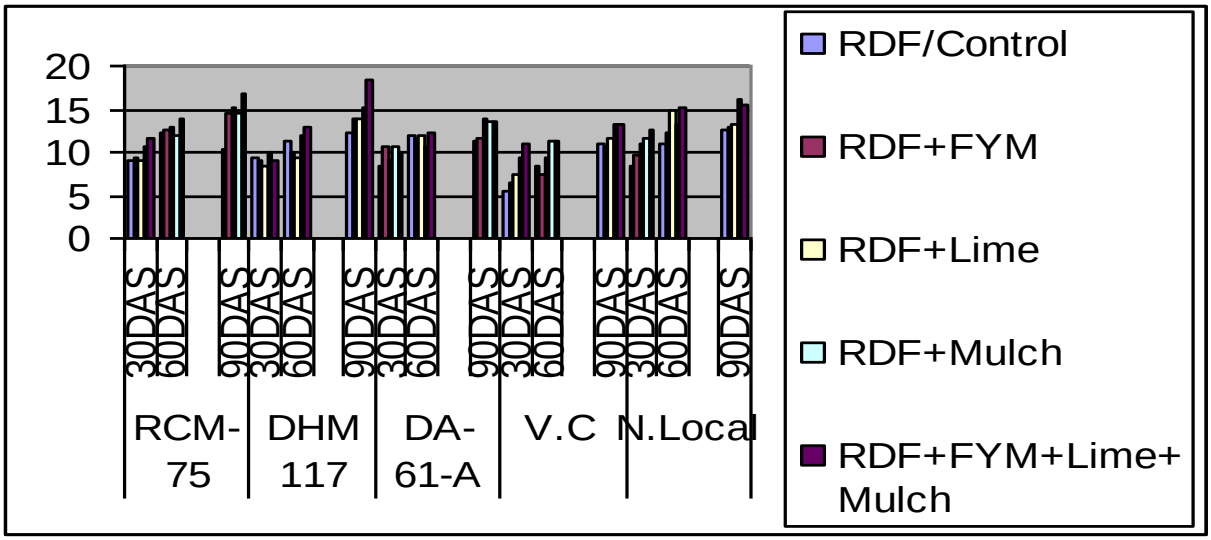

Fig 16 Variation of root length in different varieties of maize

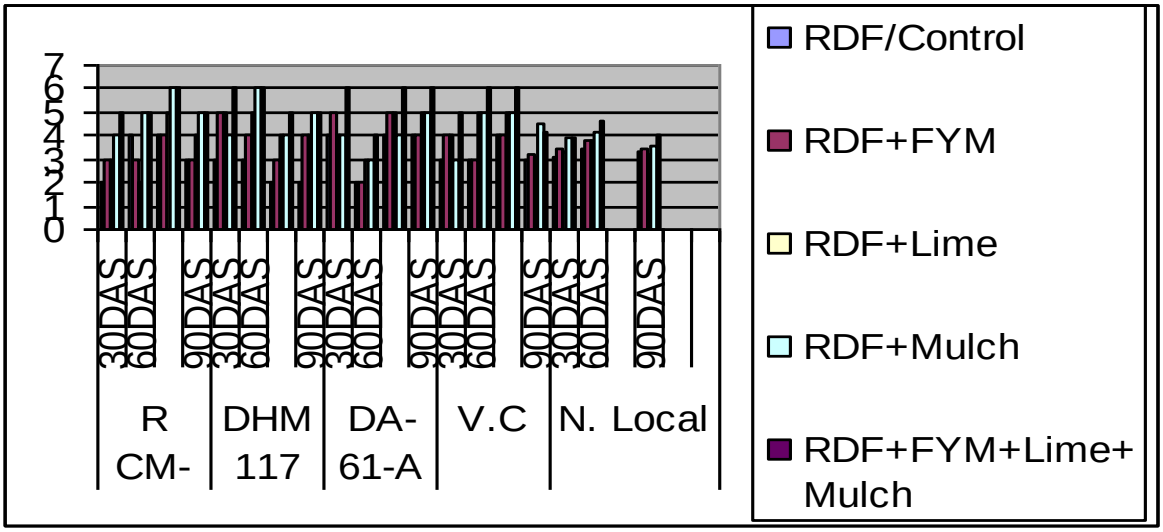

Fig 17 Variation of root volume in different varieties of maize

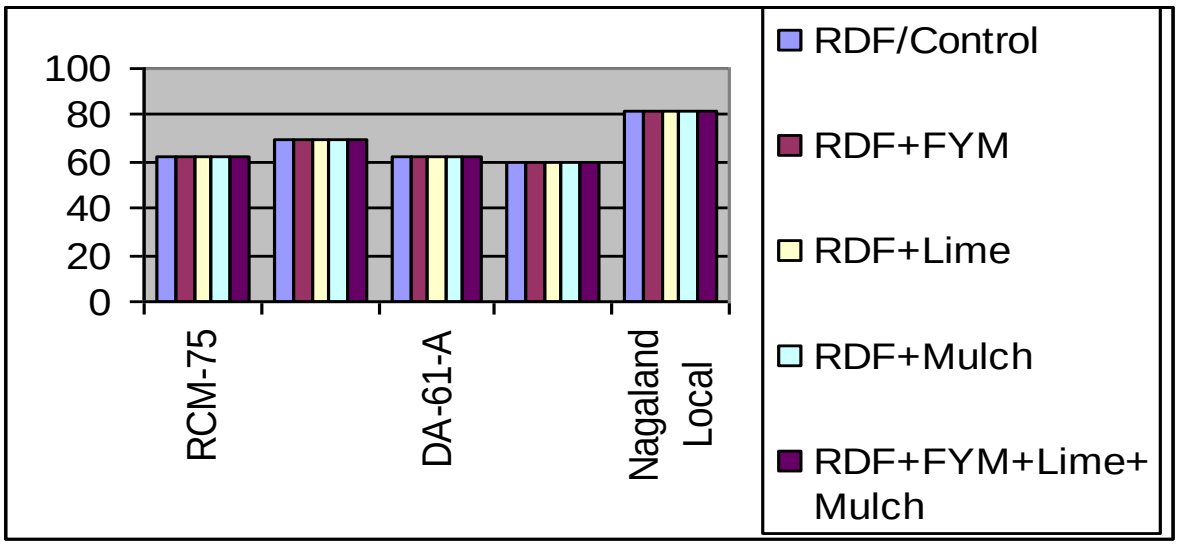

Fig 18 Variation of Days to 50% flowering in different varieties of maize.

Improvement in the conventional soil conservation measures

Traditional method of '*Echo'* being used by the farmers of Wokha district, Nagaland for soil conservation was improved upon through scientific methods using contour and graded bunding. The bunds were stabilized by planting the nitrogen fixing *Tephrosia candida.* In this system, the soil erosion could be controlled up to 42% than control.

Fig 19 Echo the traditional soil conservation method

Fig 20 Echo with scientific method

Integrated Agro-met Advisory Services (IAAS)

Bi-weekly (Tue and Fri) medium range forecast of weather was provided in Nagaland through e-mail, FAX, newspapers and radio. Weekly monsoon press release was prepared on every Wednesday. Mobile SMS on daily weather data was provided to 1191 progressive farmers across the state (Dimapur=590, Tuensang=76, Kohima=81, Mon=100, Mokokchung=49, Wokha=200, Phek=95).

Development of non-forest waste lands through agro-forestry models

Under this project, a total of 478 ha of degraded waste lands were rehabilitated through different agroforestry interventions in Mokokchung, Phek, Wokha, Kohima, Dimapur, Peren, and Mon districts. Technology was transferred through various farmers' organizations, *viz*., Union of Cooperative Societies (UCOS) of Jalukie, Phek Farmers' Association, Organic Growers' Association of Molvum and Medziphema, Transforming Livelihood Intervention Society of Medziphema, RADS of Peren etc., NGOs (e.g., World Vision, Nandi Foundation), Naga Fragrance, Village Development Council, KVKs, and ATMA. The technology such as pineapple cultivation is well-accepted in the areas of Medziphema and Jalukie, whereas large cardamom orchards and kiwi plantation are abundantly practiced in Pfusro. Ginger and turmeric cultivation is also well-accepted in several parts of Nagaland.

Fig 21 Development of non-forest waste lands through agro-forestry models

Standardization of ET estimation methods

For efficient irrigation water management and hydro-meteorological studies at both the field and catchment scales, there is a need to evaluate the existing evapotranspiration (ET) estimation methods under varied physiographical and data availability conditions. Consequently, using the ASCE-FAO-56 Penman-Monteith model as the benchmark model, a total of 16 various ET estimation methods (*viz.* FAO-24 Radiation, Hargreaves Radiation, Hargreaves Temperature, Priestley–Taylor, Jones–Ritchie, Makkink, Turc, Modified Jensen–Haise, Snyder et al. pan, FAO-24 pan, Cuenca pan, Allen-Pruitt pan, Snyder pan, Pereira et al. pan, Orang pan, and Raghuwanshi–Wallender pan evaporation) were evaluated using both the continuous daily timeseries and average timeseries weather data recorded at ICAR Research Complex for NEH Region, Nagaland Centre. The results revealed that the

Priestley–Taylor, Turc, Snyder et al. pan, FAO-24 pan, Snyder pan, and Pereira et al. pan evaporation models have restricted performances. Consequently, for an improved performance, all these models were standardized using a Genetic Algorithm based linear corrector transformation model. The main recommendations of this study for using the models were: 1. Original models with continuous timeseries weather data: ASCE-FAO-56 Penman-Monteith, FAO-24 Radiation, Hargreaves Radiation, Hargreaves Temperature, Jones–Ritchie, Makkink, and Modified Jensen–Haise models; 2. Original models with average timeseries weather data: ASCE-FAO-56 Penman-Monteith, FAO-24 Radiation, Hargreaves Radiation, Hargreaves Temperature, Jones–Ritchie, Makkink, Cuenca pan, Allen-Pruitt pan, Orang pan, and Raghuwanshi–Wallender pan evaporation models; 3. GA-based models with continuous timeseries weather data: FAO-24 Radiation, Hargreaves Radiation, Hargreaves Temperature, Jones–Ritchie, Makkink, Turc, and Modified Jensen–Haise models; and 4. GA-based models with average timeseries weather data: All the models except Pereira et al. pan evaporation model.

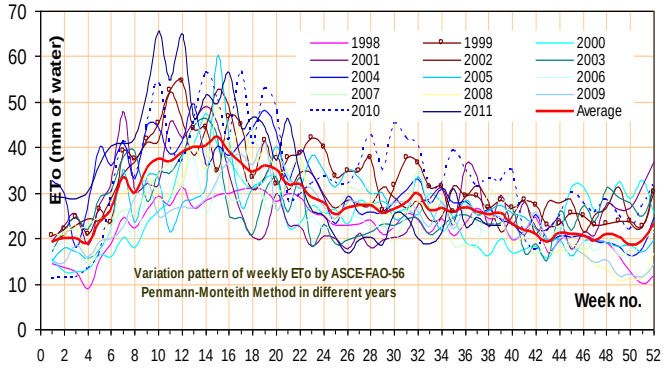

Fig 22 Weekly variations in ET

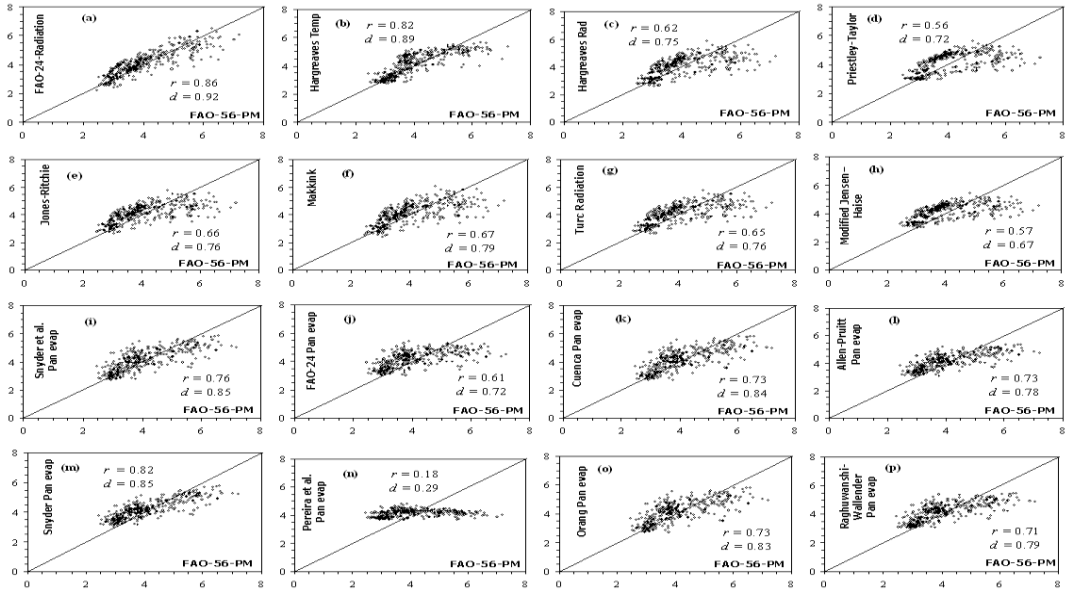

Fig 23 Comparison of all the Genetic Algorithm-based models with respect to the ASCE FAO-56 Penmann–Monteith equation using average daily time series weather data during Jan. 1998–Sep. 2011 (ETo in mm/day).

Trend analysis of weather variables

The trend analysis of ETo estimated by ASCE-FAO56-PM method reveals that there is an increasing trend of ETo during the months of February to July and October, followed by a decreasing trend during August to January except October with an annual decreasing trend of 0.42 mm/year. The maximum increasing trend of 3.88 mm/month is observed in May followed by Apr (2.71 mm/month) and Feb (2.16 mm/month). Similarly, the maximum decreasing trend of 4.47 mm/month is observed in Dec followed by Nov (2.52 mm/month). The decreasing trend in annual ETo can mainly be attributed to the annual trend of daily average of RH_{max} (+0.316%), RH_{min} (–0.688%), total number of rainy days (+0.100), and wind speed (–0.040 m/s) that caused more water vapour to remain suspended in air; thereby reducing the evaporative demand of the atmosphere ('+' and '–' signs indicate increasing and decreasing trends, respectively). This can also be evidenced from the decreasing trend of observed pan evaporation (–3.450 mm/year). Conversely, there is an annual increasing trend of 0.156 ^{o}C in daily average T_{max} and decreasing trend of 0.217 ^{o}C in daily average T_{min}, resulting in increasing trend in the difference between the daily maximum and minimum temperatures. This emphasizes to develop crop varieties which can withstand both the heat and cold stresses simultaneously. However, the trend analysis of the annual maximum (extreme) of T_{max} and annual minimum (extreme) of T_{min} shows that these trends are 0.033 ^{o}C/year and –0.183 ^{o}C/year, respectively. Similarly, an increasing trend in the total annual rainfall of 5.940 mm/year is observed without any trend in the total annual sunshine duration. However, these trends may change with the use of long-term data. Moreover, this study reveals that refinement of the existing ETo estimation models is a must for their application in different geo-meteorological and agro-ecological scenarios that affects the modeling performance under limited data-use conditions. Further, this study reveals that for irrigation water management under Nagaland condition, the pan evaporation data should not be used, which underestimate the actual evaporation rate. Hence, this study can be useful for crop planning and water management under the existing trend of global climate change.

ANIMAL SCIENCE

Understanding the unique traits in indigenous pig and poultry which make them resilient to climate change and development of database under the project 'National Initiative on Climate Resilient Agriculture'

A questionnaire was designed for conducting survey of traditional pig and poultry production practices in subtropical hill agro-ecosystem of eastern Himalayan region

(Nagaland). Survey was conducted in the selected villages of Dimapur, Peren, Wokha, Mon, Phek and Kohima districts of Nagaland. A total of 260 respondents were interviewed for indigenous pig and poultry production systems. Among the respondents, 69.23% and 81% had pig and poultry respectively as important livelihood options,.

Majority (60%) reared crossbred pigs, 50% local pigs and just 10% had initiated rearing of exotic pigs. The common feeding practice was stall feeding (60%), a very low proportion (7.78%) was scavenging with morning and evening ration, and mere 2.22% only scavenging. Feed ingredients used by the farmers were mainly kitchen waste, concentrate mixture of broken rice, wheat bran, rice brew and maize along with colocasia, tapioca, sweet potato and many non-conventional grasses, tree leaves - either cooked or raw form. The survey on production performance revealed the suitability and adaptability of Large Black cross types, Hampshire cross and indigenous Ghungroo in the region. Some common diseases affecting the pigs were piglet diarrhea (58.89%), swine fever (51.11%), endoparasite (46.67%), and ectoparasitic infestation /mange (41.11%).

The survey on poultry production system indicated that the majority of people were engaged in rearing of local poultry (77.78%) and only 22.22% started to rear improved varieties. Among the dual purpose improved poultry varieties, the Vanaraja, Gramapriya and Kruoiler were found to be suitable at different altitudes of Nagaland throughout the year. The most commonly occurring diseases were Ranikhet (61.73%), Bacillary white diarrhea (45.68%), infectious coryza (16.05%), ectoparasites/lice (9.88%), endoparasites (6.17%), and coccidiosis (6.17%) etc.

Fig 24 Survey on indigenous pig and poultry production systems in different districts of Nagaland

NAIP

Livelihood Improvement and Empowerment of Rural Poor through Sustainable Farming Systems in Mon District of Nagaland (NAIP)

Fig 25 NAIP activities at Lampong Sheanghah village, Mon district

Various technological interventions on scientific pig, poultry, and goat rearing; Water harvesting for multiple livelihood options; Terracing for wet rice cultivation; Rice and maize based cropping systems; Agroforestry interventions including horticultural orchard establishment and Skill up-gradation were undertaken in two clusters of Mon district, one of the most backward district of India recognized by the planning Commission, Govt. of India. Various site-specific low-cost water harvesting structures (*viz*., tanks, base flow harvesting, rooftop rainwater harvesting, fish ponds, and Modified Thai Jar (for kitchen gardening)), and soil erosion control measures (*viz*., contour and graded bunding, bench terracing, half-moon terracing, gully plugging, and trenching) including mulching were carried out for life saving irrigation, in-situ soil and moisture conservation. About 120 ha of abandoned *jhum* land was rehabilitated using different integrated farming system (IFS) models. The created system capacity for storing water for lean period was 82.35 thousand cubic litre; whereas, the created capacity of fish ponds to conserve water was 1.244 million cubic litre. Within a span of four years, the total crop production of this area increased from 159 t/year (baseline) to about 362 t/year. Similarly, the crop productivity (average of all the crops cultivated) increased from 4.58 t/ha (baseline) to about 6.79 t/ha. Five apiculture units (total 30 hives) and six sewing machines were also given in the cluster after providing professional training to enhance family income.

Livelihood improvement and empowerment of rural poor through sustainable farming systems in Mon district of Nagaland (NAIP- III)

Livestock intervention through backyard poultry farming was initiated. Three demonstration units with capacity of 300 birds in each unit were constructed at Lampong Sheanghah village of Mon district, Nagaland. About 840 birds were distributed to another 40 beneficiaries for livelihood support. The feedback from the farmers was very much encouraging.

Fig 26 Rural livelihood through improved variety of backyard poultry (Vanaraja) farming at Lampong Sheanghah village, Mon district, Nagaland

Rural livelihood through improved variety of backyard poultry (Vanaraja) farming at Lampong Sheanghah village, Mon district, Nagaland

Animal Health

The antibacterial sensitivity pattern against the *Escherichia coli* isolates was carried out in a total of 80 fecal samples obtained from piglet diarrhoea cases in field/farm condition in and around Dimapur district. Eighteen different antibiotics disc *viz*., sulphafurazole, amphotericin, norfloxacin, ofloxacin, trimethoprim, cefotaxime, clotrimazole. amoxicillin, furazolidone, cloxacillin, enrofloxacin, nitrofurantoin, vancomycin, cefalexin, ceftriaxone, oxytetracycline, metronidazole and sulphadiazine were selected to carry out the sensitive test for *E. coli* isolates. The samples collected from the villages had the highest sensitivity (≥13mm) towards enrofloxacin (93.33%), ceftriaxone (86.66%), ofloxacin (73.33%), norfloxacin (40%), sulphafurazole (33.33%), cefotaxime (36.67%), sulphadiazine (30%), and amoxicillin (10%) while medium sensitivity (8-13 mm) was observed towards amoxicillin (90%), nitrofurantoin (90%), furazolidone (76.66%), sulphadiazine (73.33%), cefalexin (66.67%), norfloxacin (60%), oxytetracycline (30%) and trimethoprim (30%). The resistance pattern (0-8mm) was seen against the amphotericin, clotrimazole, cloxacillin, vancomycin and metronidazole. The samples which were collected from farm showed the highest

sensitivity towards ceftriaxone (100%), norfloxacin (80%), enrofloxacin (80%), cefotaxime (66%), sulphadiazine (60%), amoxicillin (48%), ofloxacin (30%), and sulphafurazole (28%) and medium sensitivity towards trimethoprim (96%), sulphafurazole (72%), and ofloxacin (70%). The resistance pattern was observed for furazolidone, metronidazole, oxytetracycline, vancomycin, cloxacillin, clotrimazole and amphotericin. The study indicated differential sensitivity pattern against the *E. coli* isolates obtained from farm and field.