ANNUAL REPORT

(2011-2012)

ICAR RESEARCH COMPLEX FOR NEH REGION
Nagaland Centre, Medziphema-797 106
Nagaland

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1. WEATHER

1.1 Average Weather during April 2011-March 2012

The highest maximum temperature of 34.7^{0}C was recorded on 28th July'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. January 2012 was the coolest month and August 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 months from June to Sept showed the higher relative humidity. The total rainfall received during the year 2011-12 (Apr '11 to Mar '12) was 1641.40 mm and the total number of rainy days was 121 days. The monthly rainfall was the maximum in the month of June'11 (474.2 mm). No rainfall occurred during the months of Nov and Dec'11. Except during the months from Oct'11 to March '12, the sky was clear. The average monthly wind speed varied from 0.26 kmph (July '11) to 27.31 kmph (April '11). April and May months 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 (April '11).

Average monthly weather data of Nagaland (the 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) (5cm)**		**Soil temperature (^{0}C) (15cm)**		**Soil temperature (^{0}C) (20cm)**	
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)**

2. AGRONOMY

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

A field experiment was carried out in the Institute Research Farm during *rabi* season of 2011-12. The soil of the experimental site was slightly clay loam, acidic in reaction (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). This study was undertaken at 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 plot and three varieties (M-27, TS-38 and TS-36) in the sub-plot

treatment using a split-plot design with three replications. The maximum values of all the growth parameters were recorded with 150% (grain yield=0.85 t/ha) recommended dose of fertilizer which was closely followed by 125% RDF (grain yield=0.74 t/ha) and 100% RDF (grain yield=0.71 t/ha). Among the different varieties, TS-38 recorded the highest value of growth and yield attributes *viz*. plant height, leaves/plant, number of branches/plant which was at par with TS-36 in all stages of growth. Different varieties also showed significant variation in the attributes of siliquae/ plant, siliqua length and seed/siliqua. The highest values of the yield was recorded by the variety TS-38 (0.89 t/ha) which was closely followed by TS-36 (0.76 t/ha) and M-27 (0.72 t/ha), respectively.

Toria crop at flowering stage under fertility trial.

2.2 Performance of INM on production potential in dwarf pea (*Azad*):

A field experiment was carried out in the Institute Research Farm during *rabi s*eason of 2011-12. 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, 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 finally yield (grain and straw). However, 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 yield 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 yield parameters (grain and straw yield) over the control.

Dwarf pea (Azad pea) at flowering stage in INM trial.

Effect of INM on growth, yield attributes and yield on 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 Plot (Fertility level)										
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 Plot (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 Plot (Fertility level): 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 Plot (Biofertilizers+micronutrients): S_0: Control, S_1: Biofertilizers, S_2: Zn @ 5 kg/ha, S_3: Biofertilizers + Zn.										

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

This field experiment was carried out in the Institute Research Farm 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 increase all the growth attributes at various growth stages. Increase in the fertility levels from F_0 to F_3 resulted in the increase in all the yield attributes *viz*, number of capsule/plant and number of seeds/capsule. Increase in the fertility levels resulted in increase in seed and straw yield. 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.

Effect of different fertility levels on growth, yield attributes and yield on linseed

Treatments	Plant height (cm) At 90 DAS	Pri. Branch /plant (no.) At 90 DAS	Sec. Branch/ plant (no.) At 90 DAS	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)
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

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

This field experiment was carried out at Institute Research Farm 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 in split - plot design with three replications. Four levels of lime, *viz.* control (no application), 0.2, 0.4 and 0.6 tha- were allotted to the main plot where, four varieties of rice bean such as RBS -16, RBS-53, PRR-2 and RCRB-4 were allotted to the sub-plots. Results showed that the increase in the level of lime increases the yield of the rice bean varieties. Lime application 0.6 t/ha recorded significantly higher yield attributes and yield of the rice bean followed by 0.4 and 0.2 t/ha. In case of the varieties, RBS-53 recorded significantly higher yield attributes and yield of the crop as compared to the other varieties. The rice bean variety PRR-2 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.

Rice bean at flowering stage

Effect of different levels of lime application on yield attributes and yield of rice bean cultivars

Treatments	Pod length (cm)	1000-seed weight (g)	Pods/plant (No.)	Seeds/plant (No.)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
Lime application (q ha^{-1})								
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								
RBS -16	6.57	67.08	25.28	82.15	0.65	0.67	1.32	46.51
RBS-53	6.86	68.33	27.06	81.22	0.88	0.86	1.74	49.36
PRR-2	6.81	67.42	42.84	102.33	0.41	0.43	0.84	50.22
RCRB -4	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

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

This field experiment was carried out in the Institute Research Farm 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 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 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 of the crop 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.

SRI

ICM

CRC

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^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	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

2.6 Effect of date of sowing, seeding rate and integrated nutrient management on production potential of summer mungbean (var. TS-21):

This field experiment was carried out in the Institute Research Farm during the *kharif* season of 2011-12. 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 split-split plot design with three replications. Two dates of sowing *viz.* 5th and 15th April were allotted to the main plot and four seeding rates of 20, 25, 30 and 35 kg/ha was given in the sub-plot. Another treatment, fertility level was allotted in the sub-sub plot to evaluate their best applicability. The results revealed that 5th April date sowing recorded significantly the highest yield attributes and yield of the crop. In case of seeding rate, it showed that the increase in the level of seeding rate increased the yield; but reverse in case of the yield attributes. However, 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 finally highest yield followed by 100 % RDF.

Summer mungbean crops at pod formation stage

Effect of sowing date, seed rate and integrated nutrient management on yield attributes and yield of summer mungbean (var. TS-21)

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
SEm	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-1 and IN : Inorganic Nitrogen,ON: organic Nitrogen through vermicompost							

2.7 Effect of mulching, liming and integrated nutrient management on production potential of *rabi* maize (var. DA-61-A) under rainfed condition:

This field experiment was carried out in the Institute Research Farm during the *rabi* season of 2011-12. 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 split - split plot design with three replications. In this experiment, mulching was allocated in the main plot (*viz.*, control and mulching), and the sub-plot treatment was allocated with farm manure having four levels (control, 4, 8 and 12 t/ha); and in the sub-sub plot, four levels of liming (control, 0.2, 0.4 and 0.6 t/ha) were allocated. The results showed that liming recorded significantly higher yield attributes and yield in the main plot. In the sub-plot treatment, it showed that the increase in the levels of farm yard manure application, increased the yield attributes and finally yield of the crops. In sub-sub plot treatment application, similar trends were observed for farm yard application.

***Rabi* maize var. DA-61-A at vegetative stage**

Effect of mulching, liming and integrated nutrient management on production potential of *rabi* rainfed maize (var. DA-61-A)

Treatments	Cob/plant (No.)	Grains/row (No.)	Cob length (cm)	Rows/cob (No.)	Grain yield (t ha^{-1})	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^{-1})						
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^{-1})						
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

2.8 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 January, 2012. The treatment was consisted with ten 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 in nature exhibiting high humidity and medium to high rainfall. In the month of January 2012, the jungle was cleared. Before cutting the forest, soil samples were collected for analysis. In end of March, the jungle cuttings were burnt and soil samples were collected to evaluate the post burning effect. The preliminary results of the soil samples thus collected are given below in the Table.

Soil characteristics of the project site during the year 2012-13

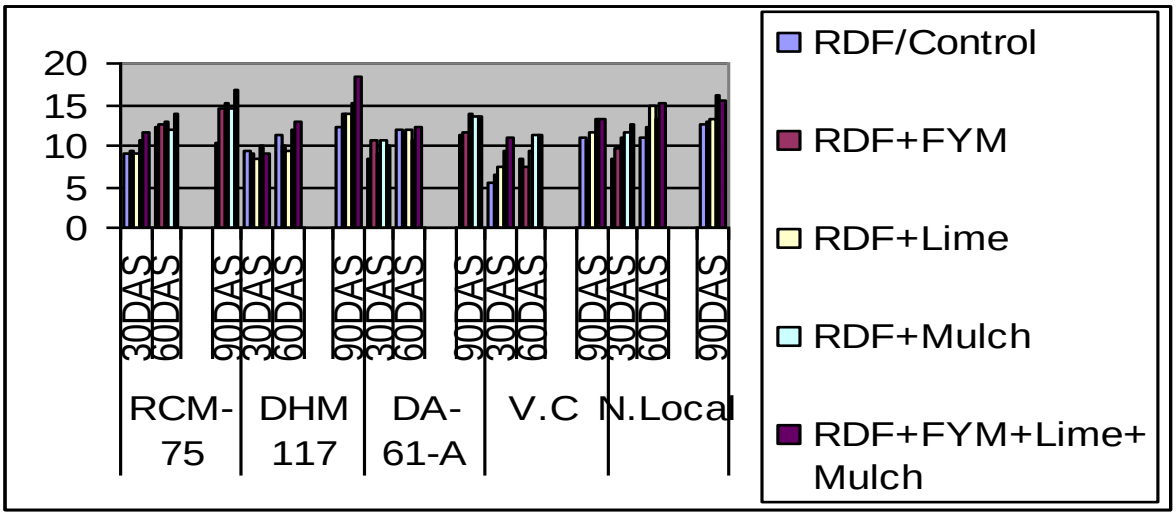
Stage	p^H	EC (dsm^{-1})	OC (%)	Avail. N (kg ha^{-1})	Avail. P (kg ha^{-1})	Avail. K (kg ha^{-1})
Before cutting	4.73	0.0596	1.02	84.67	8.23	46.75
After cutting	4.19	0.0556	0.783	137.98	8.99	91.88
After burning	5.81	0.415	1.04	166.21	9.80	290.96

2.9 Seed production program for rice, maize, toria and linseed under the Tribal Sub-Plan (TSP):

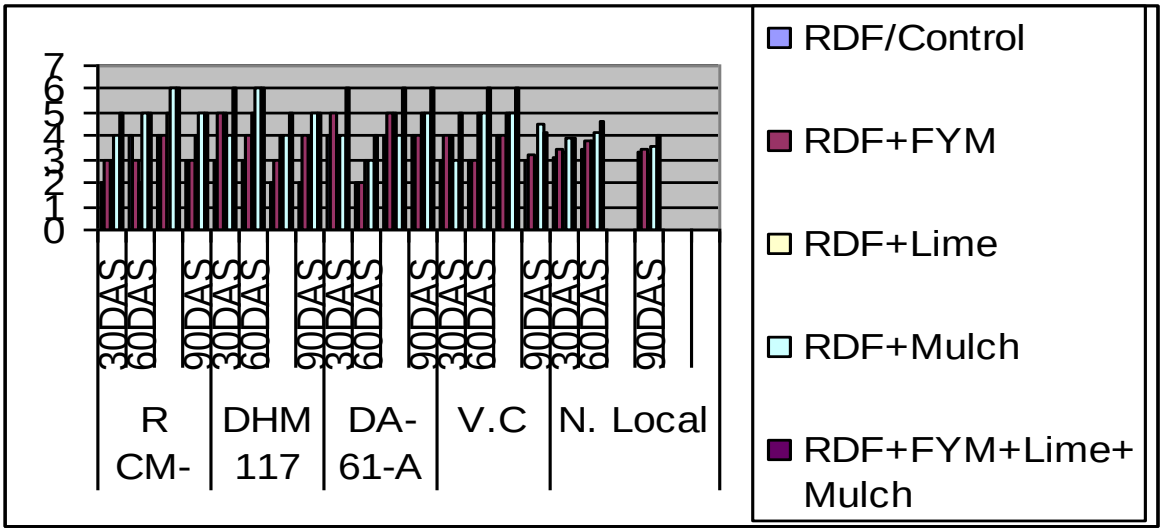
Under the Tribal Sub-plan (TSP), quality seed production program of *rabi* maize, linseed, and toria was initiated by the ICAR research Complex for NEH Region, Nagaland Centre, both in the farmers' field (in Vade village, Dimapur district) and in the Institute Research Farm during 2011-12. The total area selected for cultivation of *rabi* maize (rainfed condition) was about 2.0 ha. A total of 12 quintal of quality seeds of maize (*var.* RCM-75 and RCM-76) were produced to partially meet the huge demand of maize growing farmers. Quality seeds of toria var. TS-36 and TS-38, 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. RCM-76), Rapeseed (var. TS-36), Rapeseed (var. TS-36), and Linseed (var. Parvati) were 21 q/ha, 10q/ha, 12q/ha, and 8q/ha, respectively.

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

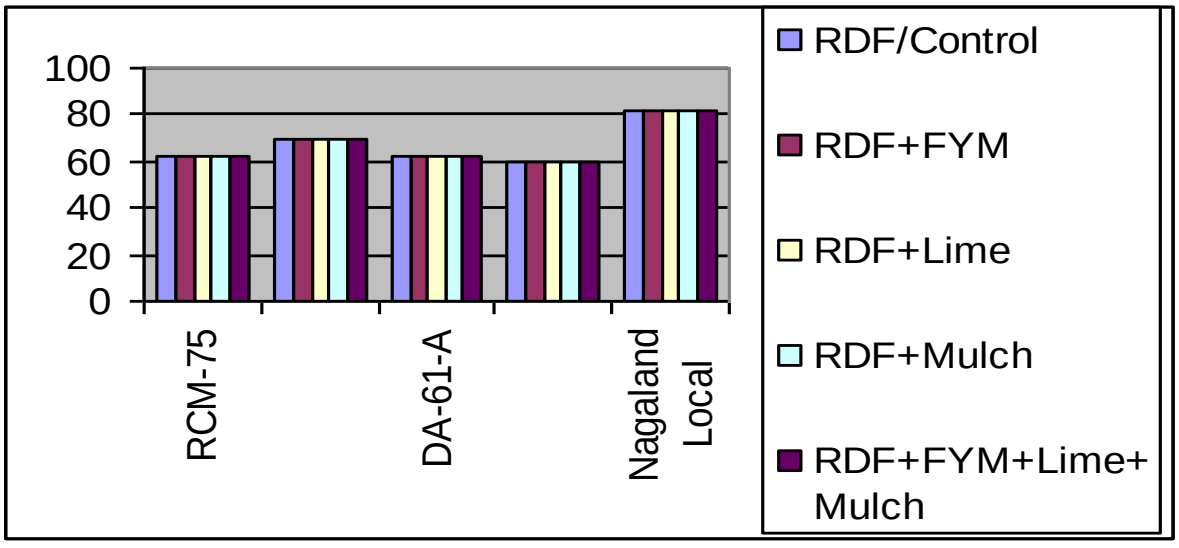
This field experiment was initiated in the Institute Research Farm under the project 'National Initiative on Climate Resilient Agriculture (NICRA) on the theme "Identification of temperature (drought/ /high temp.) tolerant rice and maize varieties for North-eastern hill ecosystem" during the *rabi* season of 2011-12 under rainfed condition. The allocated treatments were: fertility level 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 @5 q/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 such as 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 parameter 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 is due to the combined effect of the treatment which minimizes the soil moisture loss and acidity and provides 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. The more is the root length and root volume, the better is the resilience of the crop against moisture stress.



Variation of root length in different varieties of maize



Variation of root volume in different varieties of maize



Variation of Days to 50% flowering in different varieties of maize

2.11 Varietal Evaluation Trials on Paddy:

RCRT lowland paddy 01: A total number of 17 paddy lines were tested under RCRT lowland paddy-01 taking paddy variety Ranjit as control. The highest yield were recorded in the line 1-417 (5.43 t/ha). 1-302 (5.10 t/ha) and 1-308 (4.79t/ha) over the paddy variety Ranjit (4.68 t/ha).

Varieties	Yield (t/ha)
RCRT 1-300	3.44
RCRT 1-302	5.10
RCRT 1-303	3.28
RCRT 1-304	3.23
RCRT 1-307	4.21
RCRT 1-308	4.79
RCRT 1-400	4.13
RCRT 1-401	4.30
RCRT 1-403	4.57
RCRT 1-408	4.14
RCRT 1-410	5.00
RCRT 1-167	3.68
RCRT 1-187	3.86
RCRT 1-417	5.43
RCM- 21	3.24
SHAHSARANG	3.82
RANJIT	4.68
SEM(±)	0.64
CD	NS

RCRT lowland Paddy 02: The RCRT lowland paddy-02 was conducted to test the superiority of 13 paddy lines over the existing variety Ranjit (Control). Among the 13 lines, 1-149 (6.34 t/ha) recorded higher and superior yield over Ranjit (4.56 t/ha).

Varieties	Yield (t/ha)
RCRT 1-123	0.93
RCRT 1-126	4.39
RCRT 1-131	4.00
RCRT 1-134	4.30
RCRT 1-140	4.12
RCRT 1-144	3.55
RCRT 1-145	4.34
RCRT 1-147	4.39
RCRT 1-148	4.35
RCRT 1-149	6.34
RCRT 1-176	4.03
RCRT 1-160	4.39
RANJIT (Control)	4.56
SEM(±)	0.61
CD	1.78

RCRT lowland Paddy 03: The RCRT lowland paddy-03 was conducted to find out superior paddy varietal line over Ranjit (Control). However, none variety was found superior in yield over Ranjit (4.56 t/ha). The yield of Ranjit was closely followed by paddy line 475 (4.5 t/ha).

Varieties	Yield (t/ha)
RCRT 466	0.69
RCRT 467	3.73
RCRT 468	1.80
RCRT 469	2.13
RCRT 470	2.06
RCRT 471	3.79
RCRT 472	2.66
RCRT 473	4.41
RCRT 474	2.22
RCRT 475	4.50
RCRT 132	2.95
Ranjit (Control)	4.56
SEM(±)	0.58
CD	1.73

Other 13 numbers of lowland paddy varieties were also evaluated for their performance in Nagaland condition. Among the varieties, IET-16313 recorded the highest yield (5.56 t/h) which was followed by IET-18572 (5.23 t/ha).

Varieties	Yield (t/ha)
RCM- 11	4.380
RCM- 19	4.300
RCM- 20	4.050
IET- 17276	4.430
IET- 17278	4.560
IET- 18572	5.230
IET- 18564	4.930
IET- 16313	5.560
IET- 16332	4.630
TRC-87251	3.660
Shahsarang	5.200
AR-3	4.950
Lampha	3.480

3. HORTICULTURE

3.1 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.

3.2 Standardization of technologies:

Evaluation of lilium cultivars under Nagaland condition:

An experiment was carried in the Centre to evaluate the lilium varieties. Six different varieties of lilium, viz. Sulpice, Brunello, Barasso, Acauplco, Lamacha, and Carmina were planted at a distance of 30 cm×30 cm under shade net house. The experiment was laid out in RBD design with four replications. Significant difference was observed for days taken for bud emergence, plant height, number of leaves, number of buds and days taken for flowering. Among the varieties evaluated, days taken for bud emergence were earlier in Brunello (27.85 days), which was followed by Barasso (43.50 days). The highest plant height was recorded in Barasso (68.75 cm) and minimum plant height was recorded 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 maximum in Brunello (3.80) and minimum in Barasso (1.80). Days taken for bud emergence were earlier in Acaulpco (75.15 days), which was 118.45 days in case of Carmina.

Evaluation of anthurium cultivars under Nagaland condition:

An experiment was carried in the Nagaland Centre to evaluate the various anthurium varieties. Seven different varieties of anthurium viz. Violet Heart, L'Amour, Queen Black, First Red, Cynthia, Anastacia and Red were planted at a distance of 30 cm × 30 cm in the shade net house. The experiment was laid out in RBD design with three replications. 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); and the minimum plant height was recorded 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). The experiment is in progress.

3.3 Collection, characterization and conservation of indigenous landraces of colocasia from North Eastern Hills:

Twenty-five cultivars of Colocasia collected from different districts of Nagaland and adjoining Assam were planted in the experimental farm. The experiment was laid out in randomized block design 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. Among the lines evaluated, the maximum plant height was recorded in line 18 (113.96 cm), and the minimum height of 54.44 cm was

recorded in the line 6. The maximum plant span of 130.0 cm was recorded in the line 7, and the minimum span of 63.28 cm was recorded in the line 3. The maximum number of suckers was recorded in the line 6 (6.0) and minimum no. of suckers was found 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 minimum 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). The data showed that there was significant difference in the no. of cormels among the lines evaluated for this study. The highest no. of cormels was recorded by the line 21 (14.25) which were closely followed by the line 23 (14.0). The lowest no. of cormels was recorded in the line 5 (1.50) which was closely followed by the line 7 (2.0). The maximum corm weight of 715.83 g was recorded in the line 4, and the minimum corm weight of 64.50 g was found in the line 5. The highest cormel weight of 275.00 g was recorded in the line 1, and the lowest cormel weight of 20.77 g was recorded 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 for the study. 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.

3.4 Collection, characterization and conservation of rajma beans of Nagaland:

Extensive survey was conducted to identify the different rajma bean accessions in Nagaland. There were 39 different accessions collected from various places of Nagaland. The collected varieties were planted in the field in Augmented Block Design. The evaluation is in progress.

3.5 Vase life study of different lilium cultivars:

A study was conducted during 2011-12 to study the effect of holding solution (3% Sucrose + 2ppm 8-HQ) and control (distilled water) on the vase life of the lilium flowers *viz*. Sulpice, Brunello, Barasso, Acauplco, Lamacha and Carmina at room temperature. 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. Data was recorded for various parameters and analyzed statistically. Significant variation was observed among the varieties evaluated for the post harvest characters of cut lilium flowers. The maximum length and diameter of the flower bud was recorded in Lamacha variety and the minimum length and diameter of the flower bud was observed in Brunello variety. The maximum diameter of stem was observed in Barasso (0.67 cm) and minimum diameter of stem was observed 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 was recorded the maximum in Barasso. The minimum number of days taken for bud burst was observed in Brunello (2.37 days) while the minimum number of 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).

3.6 Evaluation of different tropical orchids under Nagaland condition:

An experiment was carried in Nagaland Centre to evaluate the different tropical orchid species. The species *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 that there was increase in plant height in all the species. The study is under progress.

3.7 Technology refinement and imparting trainings:

Six one-day trainings were given to the farmers at Kohima, Wokha and Dimapur districts under different topics as per the farmers' problem. One three-days training programme was organized at the Nagaland Centre for floriculture and landscaping for entrepreneurship development. A two-days North-East Horti Farmers' Meet was also organized in Medziphema in partnership with CIH, SASRD, Dept of Agriculture, Govt. of Nagaland. Four nos. of FLDs were conducted for rejuvenation of *Khasi* mandarin, improved package of practices for *Khasi* mandarin, and improved package of practices of Assam lemon.

FLD on rejuvenation of *Khasi* Mandarin

FLD on production of Assam Lemon


One-day training and demonstration on cut flower production


Training on cultivation of kiwi fruit in Khonoma village and Wokha

Floriculture and landscaping: Tips for entrepreneurship development (3 days)


North-East Horti Farmers' Meet

4. NATURAL RESOURCES MANAGEMENT

4.1 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 Mon districts of Nagaland for life saving irrigation, *in-situ* soil and moisture conservation. These 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.

Diversion irrigation channel under NICRA near Dhanshirpar village, Dimapur district

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

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 have been 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. Through this project, 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 has been increased from 159 ton/year (baseline) to about 362 ton/year. Similarly, the crop productivity (average of all the crops cultivated) has been increased from 4.58 ton/ha (baseline) to about 6.79 ton/ha. Recently five apiculture units (total 30 hives) and six sewing

machines have also been introduced and distributed in the cluster after providing professional training to enhance family income.

NAIP activities at Lampong Sheanghah village, Mon district

4.3 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.

4.4 Integrated Agro-met Advisory Services (IAAS):

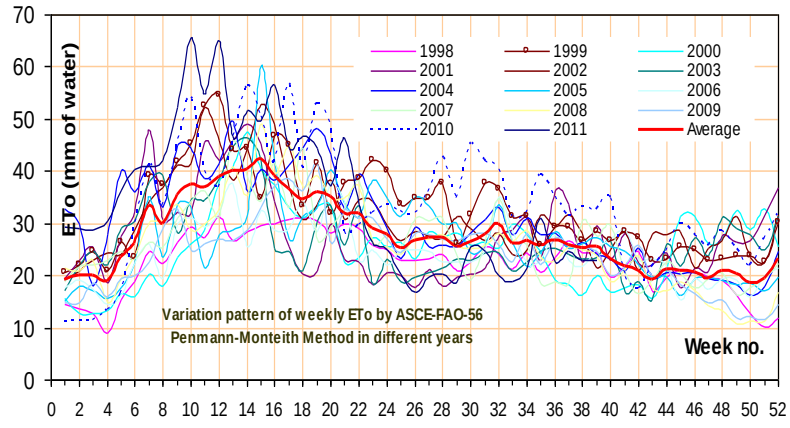
Bi-weekly (Tuesday and Friday) Medium Range Forecast of weather is being provided in Nagaland through e-mail, FAX, Newspapers and radio. Monsoon press release is being prepared once a week on Wednesday. Mobile SMS on daily weather data is being provided to 1191 progressive farmers across the state (Dimapur=590, Tuensang=76, Kohima=81, Mon=100, Mokokchung=49, Wokha=200, Phek=95).

4.5 Development of Non-forest Wastelands through Agro-forestry Models in Nagaland State of NEH Region:

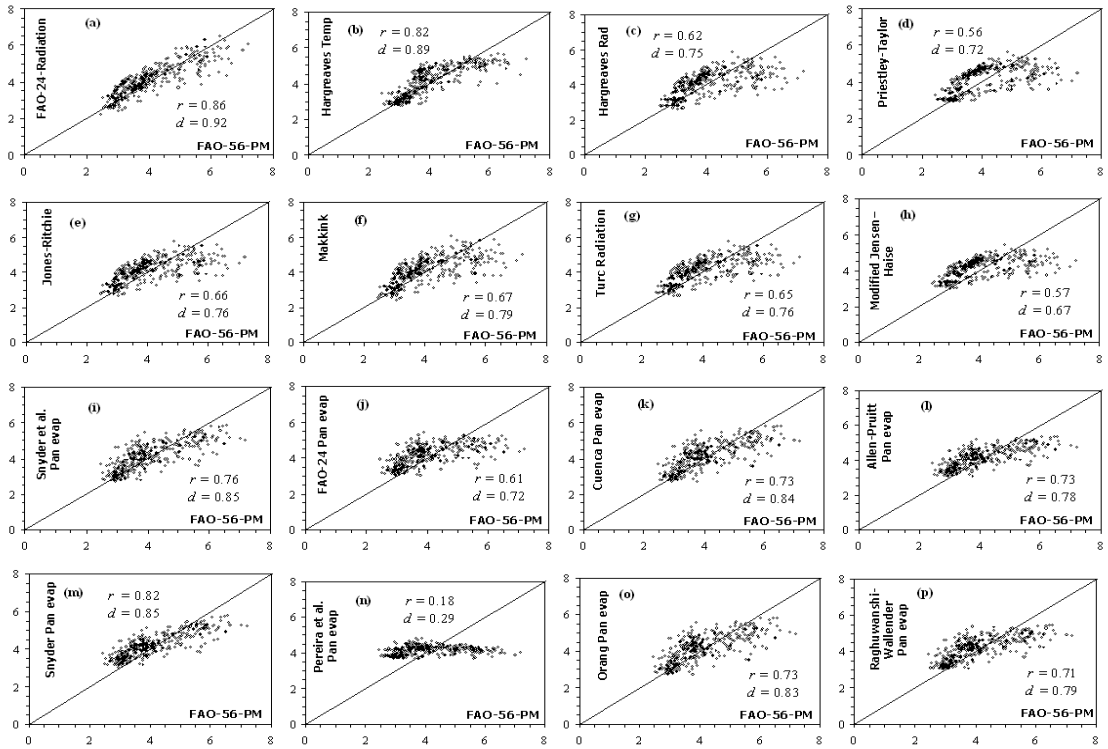
Under this project, a total of 478 ha of degraded waste lands were rehabilitated through different Agroforestry interventions in Mokokchung, Phek, Wokha, Kohima, Dimapur, Peren, and Mon districts. Technology was transferred through various farmers' organizations, viz., Union of Cooperative Societies (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.

4.6 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.



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

4.7 Trend Analysis of Weather Variables at Nagaland Centre:

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 April (2.71 mm/month) and February (2.16 mm/month). Similarly, the maximum decreasing trend of 4.47 mm/month is observed in December followed by November (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.

4.8 Network Project on *Jatropha*:

Identified a total of 11 provenances of *Jatropha* and it was found that the 'Molvum' genotype contains the highest seed oil of 38.99%, followed by the genotypes of '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. 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*.

4.9 Analysis of soil and plant samples from different districts of Nagaland:

2244 Nos. of soil sample s were analyzed in the laboratory covering 7 districts viz., Dimapur, Peren, Kohima, Wokha, Mon, Tuensang and Phek for N, P, K, Organic Carbon (OC), and pH. The ranges of average N, P, K, OC and pH of all these 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. 674 nos. of plant samples were also analyzed in the laboratory covering 7 districts viz., Dimapur, Peren, Kohima, Wokha, Mon, Tuensang and Phek for crude protein, crude fiber, ash, calcium, potassium, dry matter, nitrogen free extract, and phosphorus.

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

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. Then these samples were saturated at field capacity and transferred into a moisture proof container. After that, those samples were kept in a BOD incubator at 42°C for 1 month. Nutrient analysis data of initial and elevated temperature treated soil samples reveals that all the parameters show increasing trend due to heat treatment which may be due to the combined effect of heat induced mineralization of organic sources as well as cellular materials of psychrophilic and mesophilic organisms.

Nutrient analysis of 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^{-1})	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^{-1})	75.3-194.4	110.8	106.6-294.8	147.4

Available P (kg ha^{-1})	41.5-380.9	122.9	46.5-365.8	129.2
Available K (kg ha^{-1})	47.4-448.1	166.9	75.3-448.1	180.5

4.11 Model farming systems for resilient shifting cultivation in Nagaland:

Since the existing shifting cultivation practices in eastern and north-eastern 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. However, the preliminary soil test data showed that oxidizable organic carbon, available-K, mineralizable nitrogen, pH has increased after burning in the *jhum* area. The study is in progress.

5. ANIMAL SCIENCE

5.1. 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.

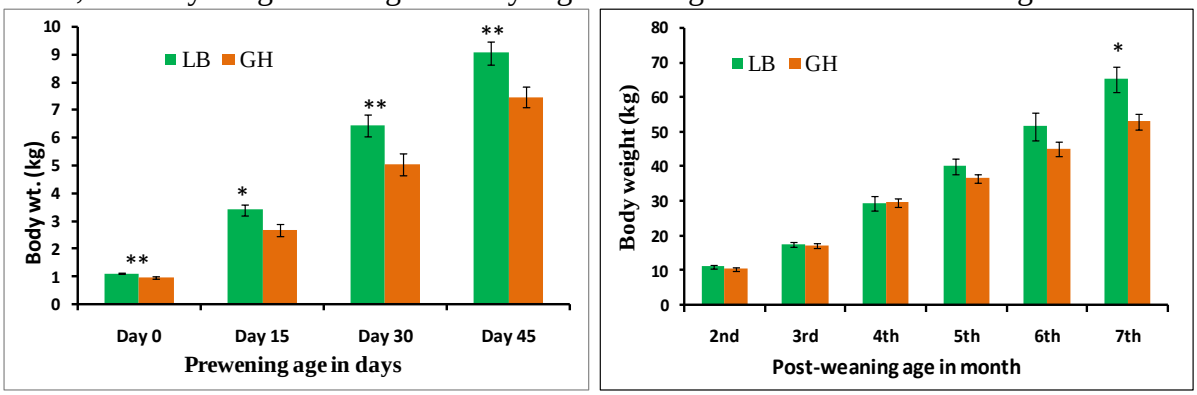
5.2. Establishment of Pig breeding unit at farmers' field:

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.

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

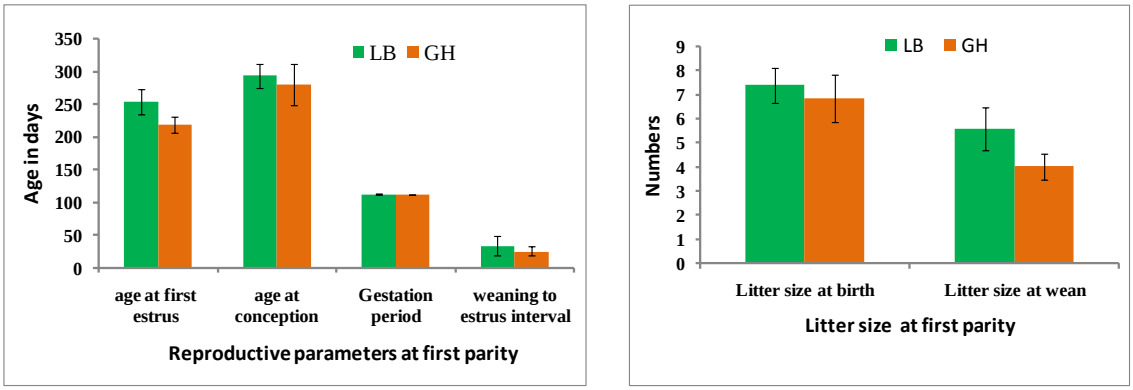
5.3. Comparative studies on productive and reproductive performances of different breeds of pig in Nagaland:

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.



Pre-weaning and post-weaning growth performance of Large Black and Ghungroo Gilts under identical management condition in Nagaland (p<0.01, * p<0.05)**

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.



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

5.4. 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 of 79,089 numbers of eggs were produced of which 60,257 numbers were set into hatchery unit and 38,401 numbers of 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. In the reporting year, a total of 26,177 (Twenty six thousand one hundred and seventy seven) numbers of day-old/grown up chicks were distributed to the beneficiaries of different districts of Nagaland and Arunachal Pradesh. During the reporting period, 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.

Beneficiaries 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

Under the Tribal Sub - Plan 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.

Demonstration units of backyard poultry farming established under Tribal Sub Plan.

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

5.5. Implementation of Tribal Sub Plan under PD_ADMAS in Nagaland:

Under the tribal sub plan 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.

During the reporting period, animal health coverage were given to approx. 300 households comprising of 317 cattle, 761 pigs, 235 goats, 316 dogs and 4697 poultry birds. Apart from complete health coverage, about 1200 chicken were distributed to 90 beneficiaries belonging to poor and marginal farming community. After the follow up treatment, the impact of the project was assessed and documentation is in progress.

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

5.5. 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':

This project was initiated with the objective to survey and documentation of indigenous pig/poultry rearing practices in different districts of Nagaland and identification of unique traits (such as disease resistance, growth, productive, reproductive performances and adaptability) resilient to climate change. 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 based on different geographical locations. A total of 260 respondents were interviewed for indigenous pig and poultry production system. Among the respondents involved in this survey, about 69.23% and 81% have pig and poultry rearing as their important livelihood options, respectively.

Majority of people (60%) used to rear crossbred pigs and 50% are still involved in rearing of local pigs and just 10% of them have initiated rearing of exotic pigs. The common feeding practice is stall feeding (60%), a very low proportion (7.78%) of farmers is practicing scavenging along with morning and evening ration, and mere 2.22% practices 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 tuber crops like 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 of the commonly occurring diseases affecting the pig production were Piglet diarrhea (58.89%), Swine fever (51.11%), endoparasite (46.67%), and ectoparasitic infestation /mange (41.11%).

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

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

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

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

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

5.7. Animal Health:

The antibacterial sensitivity pattern against the Escherichia coli isolates was carried out in a total of 80 fecal samples obtained from piglet diarrhea cases in field/farm condition in and around Dimapur district. Eighteen different antibiotics disc namely, 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 test. The zone which showed the highest inhibition towards an antibiotic disc is measured in mm scale and considered that the drug is sensitive towards E. coli isolates.

The results revealed that the samples collected from the villages have 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%). However, the resistance pattern was observed for Furazolidone, Metronidazole, Oxytetracycline, Vancomycin, Cloxacillin, Clotrimazole and amphotericin. The study indicates that differential sensitivity pattern exists against the E. coli isolates obtained from farm and field.

6. LIST OF PUBLICATIONS

Research Papers

1. Kumar, R. and Deka, B.C (2012). Evalvation of Gerbera *(gerbera jamesonll* bolus ex.hooker f.) for vegetative and flowering characters under cost effective polyhouse. Prog. Agric. 12(1):180 -185
2. Kumar, R. Deka, Bidyut C. and Roy, A.R. (2012). Evaluation of orchid species under sub-tropical mid-hills of Meghalaya. HortFlora Research Spectrum 1(1): 24-28.
3. Singh, A., Singh, B.K., Deka, B.C, Sanwal, S.K., Patel, R.K. and Verma, M.R. (2011). The genetic variability, inheritance and inter-relationships of ascorbic acid, β carotene, phenol and anthocyanin content in strawberry (*Fragaria x ananassa* Duch.). Scientia Horticulturae 129: 86-90
4. Nath, A., Swer, T.L., Deka, Bidyut C. and Patel, R.K. (2011). Nutritional Status and Value addition in Sohshang Fruit (*Eleagnus latifolia*). Beverage & Food World 38 (12): 46-48
5. Nath, A., Bagchi B., Mishra, L.K and Deka, B. C. (2011). Changes in post harvest phytochemical qualities of broccoli florets during ambient and refrigerated storage. Food Chemistry 127: 1510-1514
6. Sanwal, S.K, Kazak, M, Kumar, S. Singh, B and Deka, B.C (2011). Yield improvement through female homosexual hybrids and sex genetics of sweet gourd (*Momordica cochinchinensis* Spreng.). Acta Physiol Plant 33:1991-1996
7. Roy A.R., Patel R.S, Patel V.V, Sajeev S., Deka, B.C. (2011). Asymbiotic seed germination, mass propagation and seedling development of *Vanda coerulea* Griff ex.Lindl. (Blue Vanda): an in vitro protocol for an endangered orchid. Scientia Horticulturae 128 :325–331
8. Sajeev S., Roy A.R , Iangrai B., Pattanayak, A., Deka, B. C. (2011). Genetic diversity analysis in the traditional and improved ginger (*Zingiber officinale* Rosc.) clones cultivated in North-East India. Scientia Horticulturae 128 : 182–188
9. Baiswar, P., Chandra, S., Bag, T.K., Patel, R.K., Ngachan, S.V. and Deka, B. C. (2011). *Cladosporium oxysporum* on *Prunus nepalensis.* Australian Plant Disease Notes. DOI:10.1007/ s13314-011-0002-1
10. Kumar, R., Deka, B.C. and Roy, A.R. (2011). Effect of bioregulors on vegetative growth, flowering and corm production of gladiolus cv. Candyman. J. Ornamental Horticulture 13 (1): 35-40
11. Singh, B.K., Pathak, K.A, Verma, A.K. and Deka, B.C. (2011). Effects of vermicompost, fertilizer and mulch on plant growth, nodulation and pod yield of French bean (*Phaseolus vulgaris* L.). Vegetable Crops Research Bulletin 74:

153-165

12. Sahoo, B., Walling, I., Deka, B.C., and Bhatt, B.P. (2012), Standardization of reference evapotranspiration models for a sub-humid valley rangeland of eastern Himalayas, *J. Irrigation and Drainage Engineering*, ASCE, doi: http://dx.doi.org/10.1061/(ASCE)IR.1943-4774.0000476 (in press).
13. Kale, R.V. and Sahoo, B. (2011), Green-Ampt infiltration models for varied field conditions: A revisit, *Water Resources Management*, Springer, Vol. 25(14), 3505-3536, doi: 10.1007/s11269-011-9868-0.
14. Perumal, M., Moramarco, T., Barbetta, S., Melone, F., and Sahoo, B. (2011), Real-time flood-stage forecasting by variable parameter Muskingum stage hydrograph routing method, *Hydrology Research (Formerly Nordic Hydrology)*, Vol. 42(2-3), 150–161, doi: 10.2166/nh.2011.063.
15. Ahmad, S., Kumar, H., Singh, G., and Patra, M. K. (2011). The administration of GnRH plus $PGF_2\alpha$ synchronizes the estrus in anestrus crossbred cows exposed to bull urine. *Indian Journal of Veterinary Research*, 20(1), 42-45.
16. Patra, M.K., Barman, P. and Kumar, H. (2012). Potential Application of Pheromones in Farm Animal Reproduction: A Review. *Agricultural Reviews*, 33(1), 82-86.
17. Kumawat N., Singh R P and Kumar Rakesh. (2012). Response of intercropping and integrated nutrition on production potential and profitability on rainfed pigeonpea. *Journal of Agricultural Science*. Vol. 4, No. 7, July 2012 Accepted.
18. Sabha J., Singh J P, Kumar Rakesh and Prakash Pravin. (2012). Effect of nitrogen and sulphur levels on yield, economics and quality of QPM hybrids under dryland condition, India. *Journal of Agricultural Science.* 4(8), August 2012 (in press).
19. Dhudwal, B.L., Yadav, S.K., Kumar Rakesh, Meena, R.L. and Md. Hassim (2011). Performance and production potential of mustard (*Brassica juncea L.*) to different level of irrigation in the Central plain zone of Uttar Pradesh. *Agricultural Science Digest* (Accepted, D-3813).
20. Shivran R K, Kumar Rakesh and Kumari, Anupma. (2011). Influence of sulphur, phosphorus and Farm Yard Manure on yield attributes and productivity of maize (*Zea mays L.*) in humid south eastern plains of Rajasthan. *Agricultural Science Digest* (Accepted, D-3742).
21. Shivran R K, Rokadia P and Kumar Rakesh. (2012).Phosphorus and sulphur nutrition with P- solublizing inoculation enhanced the quality and yield of soybean(JS-335).*The Madras Agricultural journal* 99 (1-3), 68-72.

Conferences papers

1. Perumal, M., Sahoo, B. and Rao, M.S. (2012), A simplified channel routing scheme suitable for adoption in SWAT model, *2012 International SWAT Conference*, Indian Institute of Technology Delhi, New Delhi, July 18-20, 2012 (Paper Accepted). < http://swatmodel.tamu.edu/conferences/2012 >

2. Perumal, M., and Sahoo, B. (2012), Comparison of variable parameter Muskingum-Cunge and variable parameter McCarthy-Muskingum discharge routing methods, *World Environmental and Water Resources Congress 2012*, Albuquerque, New Mexico, May 20-24, 2012 (Paper Accepted). <http://content.asce.org/conferences/ewri2012/ >

3. Perumal, M., Kale, R.V., and Sahoo, B. (2011), Hydrological applications of the Approximate Convection-Diffusion equations, In: *Proceedings of the World*

Environmental and Water Resources Congress 2011: Bearing Knowledge for Sustainability, R.E. Beighley and M.W. Kilgore (Eds.), ASCE Conf. Proc., May 22-26, 2011, Palm Springs, CA, ISBN: 978-0-7844-1173-5, 4109-4120, doi:10.1061/41173(414)427.

Abstracts

4. Thirugnanavel, A., B. C. Deka, N. Walling and M. Meyase (2011). Genetic diversity of colocasia (*Colocasia esculenta* L.) in Nagaland. *Global Conference on aroids: Opportunities and challenges*, Regional centre, CTCRI, Bhubaneswar, January 23 – 25, 2012.

5. Loyi, T., Kumar, H., Nandi, S. and Patra, M.K. (2011). Selected proinflammatory transcripts in buffalo endometrial epitelial cells are elevated in subclinical and sub clinical endometritis. National Symposium on "Reproductive biotechnologies for augmenting fertility and conservation of animal species with special reference to North Eastern Hill region" and XXVII Annual Convention of ISSAR at College of Veterinary Science & A.H., CAU, Aizawl during September 27-29, 2011.

6. Patra, M.K., Ngullie, Ebibeni, Barkotoky, D., Sanchu, V., Ngullie, Lily and Das, R.K. (2011). Spina bífida in piglet. National Symposium on "Reproductive biotechnologies for augmenting fertility and conservation of animal species with special reference to North Eastern Hill region" and XXVII Annual Convention of ISSAR at College of Veterinary Science & A.H., CAU, Aizawl during September 27-29, 2011.

7. Patra, M.K., Kumar, H., Nandi, S., Loyi, T., Islam, R. and Krishnan, B.B. (2011). Differential polymorphonuclear cell functions and haemato-biochemical alteration with relation to reproductive disorders in periparturient buffaloes. National Symposium on "Reproductive biotechnologies for augmenting fertility and conservation of animal species with special reference to North Eastern Hill region" and XXVII Annual Convention of ISSAR at College of Veterinary Science & A.H., CAU, Aizawl during September 27-29, 2011.

8. Krishnan, B.B., Kumar, H., Singh, S. K., Islam, R., Loyi, T., Patra, M.K. and Gokuldas, P.P. (2011). The peripheral blood polymorphonuclear cell functions in subclinical endometritic and normal cows. National Symposium on "Reproductive biotechnologies for augmenting fertility and conservation of animal species with special reference to North Eastern Hill region" and XXVII Annual Convention of ISSAR at College of Veterinary Science & A.H., CAU, Aizawl during September 27-29, 2011.

9. Ngullie, L., Patra, M.K., Ngullie, E., Das, R.K. and Sanchu, V. (2011). Hermaphroditism in pig: A case study. National Symposium on "Reproductive biotechnologies for augmenting fertility and conservation of animal species with special reference to North Eastern Hill region" and XXVII Annual Convention of ISSAR at College of Veterinary Science & A.H., CAU, Aizawl during September 27-29, 2011.

Book / Book Chapters

10. Deka, B. C., Thirugnanavel, A and Sharma, A (2012). Floriculture and landscaping: Tips for entrepreneurship development. Published by ICAR Research Complex for NEH Region, Nagaland Centre

11. Deka B. C., Sahoo, B., Patra, M. K. Thirugnanavel, A., Kumar, R. and Chatterjee, D. (2012). ICAR Research Complex, Nagaland Centre at a glance. Published in Mithun Festival 2012. NRC on Mithun. 12-13 Jan, 2012.

12. Deka B. C., Sahoo, B., Patra, M. K. Thirugnanavel, A., Kumar, R. and Chatterjee, D (2012). Progress report (2006-2011) of ICAR Research Complex for NEH Region, Nagaland Centre submitted to Quinquennial Review Team (QRT) in QRT meeting held on December 3, 2011.

13. Perumal, M. and Sahoo, B. (2012), Approximate Convection–Diffusion Equations for Hydrological Analyses of River Flood Dynamics, Chapter-7, In: *Flood Risk and Flood Management*, T.S.W. Wong (editor), Nova Science Publishers, Inc., New York, USA, ISBN: 978-1-62081-220-4.

<https://www.novapublishers.com/catalog/product_info.php?products_id=32518>

14. Sahoo, B. and Bhatt, B.P. (2011), Multiple Water Use System for Sustainable Agriculture in North-Eastern Hilly Regions of India, In: *Water Management in the Hill Regions–Evidences from Field Studies*, K. Palanisami, V. N. Sharda and D. V. Singh (editors), International Water Management Institute and Indian Council of Agricultural Research (in press).

15. Nandi, S. and Patra M.K. (2011). RNA Extraction, cDNA Preparation and Relative Expression of IL-1β/TLR-4 From Uterine Biopsy Samples of Endometritic Buffalo. In training manual: Advances in reproductive technologies to augment fertility in farm animals. Published by Indian veterinary research Institute, Izatnagar.

16. Patra, M.K. (2011). A Scientific Approach to Swine Breeding Management. Training Manual on Scientific Pig Farming for the Women Farmers of Nagaland. Published by IGRTA, IGNOU Agartala Regional Centre, Tripura, pp: 2-6.

7. TRAINING, SEMINAR, SYMPOSIA, WORKSHOP, MEETING ETC. ATTENDED BY THE SCIENTIST/ JOINT DIRECTOR

1. Dr. B. Sahoo attended 14-day training programme on "Implementation of frontier technologies for enhancing water productivity in agriculture" at Directorate of Water management (DWM), Bhubaneswar during September 6-19, 2011.
2. Dr. A. Thirugnanavel participated 21 days training Programme on "Advances in rootstock for overcoming the biotic and abiotic stresses in fruit crops" held at Indian Agricultural Research Institute during Nov 15 – Dec 6, 2011.
3. Dr. A. Mishra, Dr. B. Sahoo, Dr. M.K. Patra, Dr. A. Thirugnanavel and Shri rakesh Kumar organized a two-day Interactive Meeting cum Workshop on "Alternative to Shifting Cultivation" between experts and shifting cultivators (*Jhumias*) during June 29-30, 2011 at ICAR Research Complex for NEH Region, Nagaland Centre.
4. Dr. B. Sahoo and Dr. A. Thirugnanavel participated in the Mithun Conference and Mithun festival organized by NRC on Mithun during 12 – 14 January, 2012.
5. Dr. B.C. Deka and Dr. A. Thirugnanavel organized training on "Floriculture and Landscaping – Tips for entrepreneurship development" held at ICAR Nagaland Centre, Jharnapani during 5 – 7 March, 2012.
6. Dr. A. Thirugnanavel participated the HTM meeting organized by State Department of Horticulture, Kohima on 23rd March 2012.

7. Dr. A. Thirugnanavel, Dr. B.C. Deka, Dr. M.K. Patra, and Dr. D. Chatterjee organized North East Farmer's Meet at Medziphema during 27 – 28 March, 2012.
8. Shri Rakesh Kumar attended 6-days SAS Training Programme at Barapani from the Period 7-12 March 2011.
9. Shri Rakesh Kumar attended summer/winter school on the topic Resource Conservation Technology for Enhancing Input Use Efficiency and Sustainable Pulse Production at IIPR Kanpur during 8-28th Sept 2011.
10. Shri Rakesh Kumar attended 8-days Training Programme on "Carbon management in Agriculture" at Barapani from the Period 1-8th February 2012.
11. Dr. M. K. Patra participated in the National Symposium on "Reproductive biotechnologies for augmenting fertility and conservation of animal species with special reference to North Eastern Hill region" and XXVII Annual Convention of ISSAR at College of Veterinary Science & A.H., CAU, Aizawl during September 27-29, 2011
12. Dr. M. K. Patra participated the Annual Review Meeting of AICRP/MSP Scientist meet at Veterinary College, M.P. University of Veterinary &Animal Science, Jabalpur, M.P. on 21st November, 2011.
13. Dr. M. K. Patra participated in the ILRI sponsored workshop on "Development challenges and opportunities for Pig production and marketing in Dimapur" at Dimapur on May 12, 2011.
14. Dr. M.K. Patra acted as member expert in IGNOU sponsored training program on scientific management of Piggery organized by KVK Dimapur. July 25-26, 2011
15. Dr. M.K. Patra acted as member of 8th meeting of State level sanction and monitoring committee (SLSMC) for Nagaland state at Nagaland Bamboo Resource Centre, Dimapur. December 9, 2011.
16. Dr. M.K. Patra participated state level workshop for senior bank officials on GOI sponsored schemes under Animal Husbandry sector for Nagaland state at Nagaland Bamboo Resource Centre, Dimapur. December 9, 2011.
17. Dr. M.K. Patra Participated in the workshop on PERMIS NET, PIMS and HYPM at ICAR Research Complex for NEH Region, Umiam, Barapani on 04.04.2012.
18. Dr. M.K. Patra acted as member expert in NABARD sponsored training on Scientific Poultry Management and presented a lecture on 'Management of grower chicken' at KVK Dimapur on August 17, 2011.
19. Dr. M.K. Patra attended a meeting on Technology Licensing and Commercializing at ATIC, ICAR Complex for NEH Region, Umiam on September, 21st 2011.
20. Dr B. C. Deka, Dr. B. Sahoo, Dr. M. K. Patra, Mr. Rakesh Kumar, Dr. D. Chatterjee attended Quinquennial Review Team (QRT) meeting held on December 3, 2011.
21. Dr B. C. Deka, Dr. B. Sahoo, Mr. Rakesh Kumar, Dr. D. Chatterjee attended the National Workshop on Climate Resilient Agriculture held at ICAR Research Complex, Barapani during February 28-29, 2012.
22. Dr B. C. Deka, Dr. B. Sahoo, Dr A. Thirugnanavel, Mr. Rakesh Kumar, Dr. D. Chatterjee attended the Brain storming session on strategies for propagation and augmenting productivity of Mithun on January 12, 2011 organised by NRCM, Jharnapani, Nagaland
23. Dr. B. C. Deka, Dr. M. K. Patra, Dr A. Thirugnanavel, Dr. D. Chatterjee attended launching workshop of NICRA on 7th September, 2011 at Dhansiripar village of Dimapur district of Nagaland.
24. Dr B. C. Deka, Dr. M. K. Patra, Dr A. Thirugnanavel, Mr. Rakesh Kumar, Dr. D. Chatterjee attended North East Horti Farmers' Meet on "Farmers' perspective of Horticulture 2020" on 27th March, 2012 at SASRD, Medziphema, Nagaland.

25. Dr B. C. Deka, Dr. B. Sahoo, Dr. D. Chatterjee attended inaugural function of KVK at Longleng district of Nagaland on 10th December, 2011.
26. Dr B. C. Deka, Dr. M. K. Patra, Dr A. Thirugnanavel Dr. D. Chatterjee participated in seed distribution ceremony at Jalukie village, Peren district, Nagaland on 28th April, 2012.
27. Dr D. Chatterjee organized one day awareness programme on "Soil Conservation and Rain Water Harvesting" at Medziphema Lotha Baptist Church for 100 farmers on 30th March, 2012.

8. IMPORTANT VISITORS

- Dr. S.S. Baghel (EX Vice Chancellor, AAU), Dr. Shyam Singh (Ex Director, NRC Citrus), Dr. Arun Verma (Ex ADG, Animal Science), Dr. V.P. Singh, D.K. Morothia, and Dr. S. Bhan, QRT Members visited during December 3 – 4, 2011.
- Dr. Dr. P Rethinam, Ex ED (APCC) and Ex ADG (PC), ICAR visited during December 16 – 17, 2011.
- Dr. S.P. Ghosh, Ex DDG (Horticulture) visited on January 9, 2012.
- Dr. K.M. Bujarbaruah, Vice Chancellor, AAU, Jorhat visited on March 27, 2012.

9. LIST OF ON-GOING PROJECTS

1. **List of ongoing projects (Institute based)**

Evapotranspiration Modeling for Water Balance Study in Nagaland	Institute Plan Project
Modeling the Physical Processes of Soil Temperature Profile using Meteorological Variables	Institute Plan Project
Comparative studies on productive and reproductive performances of different breeds of pigs in Nagaland	Institute Plan Project
Collection, characterization and documentation of Rajma beans in Nagaland	Institute Plan Project
Validation of ITK in weed management of *jhum* rice	Institute Plan Project
Seed production plan in rice, maize, linseed, and toria under TSP	Institute Plan Project (TSP)
Model farming systems for resilient shifting cultivation in Nagaland	Institute Plan Project (TSP)
Fruit based farming system model	Institute plan project (TSP)

2. **List of externally funded projects**

Project Title	Project Category / Funding Sources
Livelihood Improvement and Empowerment of Rural Poor through Sustainable Farming Systems in Mon District of Nagaland (NAIP-III)	Others/ NAIP-World Bank
National Initiative on Climate Change Agriculture	Others/ CRIDA & ICAR
Technology mission for integrated development of horticulture in	Others/ Ministry of

North-Eastern states including Sikkim	Agriculture, GOI
Integrated Agro-met Advisory Services (IAAS)	Others / Ministry of Earth Science, GOI
Mega Seed Project on Pig	Others / NRC on Pig, ICAR
Poultry Seed Project	Others / PDP, Hyderabad, ICAR
Implementation of tribal sub plan under the PD_ADMAS in Nagaland	Others / PD_ ADMAS, ICAR
Collection, conservation and characterization of colocasia germplasm from North-Eastern hills	Others/ PPV&FRA
Development of Non-forest Wastelands through Agro-forestry Models in Nagaland State of NEH Region	Others / Ministry of Rural Dev., GOI
Network Project on Integrated Development of *Jatropha*	Others/ NOVOD Board, GOI

10. LIBRARY

Total no. of books at present = 1623

- General = 212
- Veterinary Science = 369
- Chemistry = 83
- Soil Science = 117
- Agriculture engineering = 112
- Statistics = 22
- Forestry = 109
- Agronomy = 112
- Swamy's Hand Book = 22
- Horticulture = 92
- Entomology = 160
- Plant Pathology = 213

Total no. of Hindi books = 497

Received Annual Reports from

- ICAR-RC for NEH Region Shillong, Meghalaaaya
- Directorate of Agriculture, Kohima, Nagaland
- Sugarcane Breeding Institute, Coimbatote
- Indian Lac Research Institute, ICAR, Ranchi, India
- Central Potato Research Institute, ICAR, Shimla
- Jute Technology Research Laboratory, ICAR, Calcutta
- National Bureau of Soil Survey and Land Use Planning, ICAR, Nagpur
- Sri Ramakrishna Seva Kendra
- National Research Centre for Agroforestry, Jhansi

- Department of Agriculture Research and education, Ministry of Agriculture, Govt. of India
- Nagaland
- Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora
- AICRP on Linseed, Kanpur
- ICAR- RC for NEH Region, Sikkim Centre
- NRC on Mithun, ICAR, Nagaland Centre
- ICAR, Research Complex for NEH Region, Basar, Arunachal Pradesh
- NABARD
- NRC on Pig, ICAR, Raani, Guwahati
- NRC for Orchids, ICAR, Pakyong, Sikkim, India
- ICAR- RC for NEH Region, Tripura Centre

Received Journals from

- Allelopathy Journal
- Indian Journal of Animal Reproduction
- Indian Journal of Animal Research
- The Royal Veterinary Journal of India
- Indian Journal of Animal Sciences
- Indian Veterinary Medical Journal
- Veterinary World
- Asian Journal of Bio-Science
- Asian Journal of Experimental Chemistry
- Indian Journal of Agriculture Science
- Indian Horticulture
- Indian Journal of Ecology and Environmental Sciences
- Indian Journal of Forestry

Received Newsletters from

- Monthly Newsletter on the North East India, Ministry of Home Affairs, Govt. of India
- Agricomplex, ICAR, RC for NEH Region, Umiam, Meghalaya
- Cadalmin, CMFRI Newsletter (Central Marine Fishery Research Institute)
- Agrobios
- KVK Newsletters
- Tamil Nadu Veterinary and Animal Science University
- Vivekanada parvatiya Krishi Anusandhan Sansthan, Almora
- IARI News
- ICAR, A Science and technology Newsletter
- Agrinews, Department of Agriculture and Co-operation, Ministry of Agriculture, Govt. of India
- IMMA News (Indian Micro Fertilizers Manufactures Association)
- Central Potato Research Institute

Received Technical and Extension Series from

- ICAR Reporter
- Mithun Digest, NRC on Mithun
- Nutrition News, National Institute of nutrition
- Marine Fisheries Information service
- Rashtriya Krishi (Hind Agricultural Research and training Institute)
- Agri Export Advantage, Export-Import Bank of India
- Agricultural Extension Review
- Poultry Planner
- MGIRI (Mahatma Gandhi Institute for Rural Industrialization)

Daily Newspapers

- The Telegraph
- The Times of india
- Purvanchal Prahari
- Nagaland Post

Weekly Magazine

- India Today
- Employment News