



“EFFECT OF INTEGRATED NUTRIENT MANAGEMENT UNDER SYSTEM OF RICE INTENSIFICATION ON GROWTH AND YIELD OF RICE (*Oryza sativa* L.)”

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ABSTRACT

An experiment was conducted at experimental research farm Rampur, Doon (PG) college of Agriculture and Allied sciences, Camp Road, Selaqui, Dehradun “Effect of Integrated Nutrient Management under system of rice intensification on growth and yield of rice (*Oryza sativa* L.)” during Kharif season of 2016. Nine treatments *viz.*, Control (T₀), NPK (RDF) (T₁), NPK + FYM @ 12.5 t/ha (T₂), NPK +Vermicompost @ 5t/ha (T₃), NPK +Poultry manure @5 t/ha (T₄), NPK + Biofertilizer @ 1kg/ha (T₅), NPK + FYM + Biofertilizer @ 1kg/ha (T₆), NPK + Vermicompost + Biofertilizer @ 1 kg/ha (T₇), NPK + Poultry manure +Biofertilizer @ 1kg/ha (T₈) conducted in a randomized block design (RBD) with three replications. Rice variety “PS-5” was used as test crop. The soils of experimental plot was loamy sand in texture, low in organic carbon and available nitrogen, medium in available Phosphorus and rich in Potassium status. The results of the experiment indicated that maximum value of plant growth and yield attributes *viz.*, Plant height, No of tillers per hill, Plant dry matter, Panicle length, No of grains/panicle, Test weight (1000 grain weight), Grain yield, Straw yield and Harvest index, were conspicuously increased with the application of NPK + FYM +Biofertilizer @ 1 kg/ha (T₆) and was superior over rest of the treatments but at par with NPK + Vermicompost + Biofertilizer @ 1 kg /ha (T₇), NPK +Poultry manure + Biofertilizer @ 1 kg/ha (T₈). Fertilizing the crop with the integration of NPK in conjunction with FYM and Biofertilizer (T₆). Remarkably secured the significantly higher grain (4973 kg/ha) and Straw (5981 kg/ha) yield. However, treatments NPK + Vermicompost + Biofertilizer @ 1kg/ha (T₇), NPK + Poultry manure +Biofertilizer @ 1kg/ha (T₈), were statistically at par with treatment T₆ but significantly higher than rest of treatments. Similarly, protein content in grains of Transplanted Rice, nitrogen, phosphorous and potassium uptake by Rice crop were recorded higher under the application of same treatment T₆ and T₇, followed the similar pattern to yield response.

KEYWORDS: NPK, FYM, Vermicompost, Yield, Manure, Rice.

INTRODUCTION

Rice (*Oryza sativa* L.) is one the arena’s maximum critical food crops. Rice is the staple food for half of humanity, in particular the terrible. Currently, multiple third of human population is based on rice for his or her day by day subsistence. Rice is the principle staple weight-reduction plan inside the Asia and the pacific place, providing almost 39% of calories (Yaduraju, 2013). Almost 90% of the full rice is produced and fed on in Asia. Rice performs a vital role in Indian agriculture and is staple meals for greater than 60% of the populace. During 2014-15 rice become produced on 102.04 million ha land and production of rice in the course of 2014-15 was 102.04 million lots (Anonymous, 2016). Vavilov taken into consideration that India and Burma will be the centres of beginning of cultivated rice. Rice belongs to circle of relative’s poaceae, sub-family Bamboosoideae, tribe Oryzeae. Two cultivated species of rice are *Oryza sativa* L. and *Oryza glaberrima* S. among these *Oryza sativa* L. Is broadly grown in Asia, components of Europe and America. *Glaberrima* S. Is grown simplest in Africa. The cultivated species of *Oryza sativa* L. Are further divided into Japonica, Javanica and Indica, primarily based on morphological and physiological characteristics. These

sub-species fluctuate in their geographical distribution. Nutritionally, rice carries 80% carbohydrates, 7-8% protein, 3% fat and 3% fibre (Juliano, 1985). Medicinally, it’s miles valued for curing ailments like diarrhoea, vomiting, fever, haemorrhages, chest ache and burns (charaka samhita C. 700BC; and susruta samhita, c. 400BC). Food protection in India (1.6 billion via 2050 a good way to require 450 Mt of food grain manufacturing) is a project. And therefore, a few modern rice manufacturing exercise is wanted to satisfy its developing demand because of population strain. Under this situation, the System of Rice Intensification (SRI) may be the suitable practice to produce extra meals with much less input. The foundation of SRI is traced to a small island united states of America, the Madagascar, which was beneath the excessive grip of hunger and malnutrition during the 1980’s. In seek of a method to the meals crisis; Fr. Henry de Laulanie rediscovered this novel small land holdings-oriented education of SRI (Laulanie, 1993). The System of Rice Intensification (SRI) is suggested to have advantages like decrease seed requirement, much less pest assault, shorter crop period, higher water use efficiency and the ability to face up to better degree of moisture strain than traditional method of rice cultivation (Singh,

Y.V. Et al. 2013). So, the existing research on reaction of rice to INM on yield attributes, yield and economics of SRI for reaching maximum production has been performed.

MATERIALS AND METHODS

Field test changed into carried out during Kharif season of 2016 in Doon (PG) college of Agriculture and Allied Science, Dehradun (Uttarakhand). The soil of experimental web site is classified as "mollisols". Soil become sandy loam in texture having medium natural carbon, to be had nitrogen, phosphorus and potassium content material with impartial in response. The experiment changed into specified in a Randomized Complete Block Design with nine treatments replicated three times. The treatments had been Control (T0), NPK (RDF) (T1), NPK + FYM @ 12.Five t/ha (T2), NPK + Vermicompost @ five t/ha (T3), NPK + Poultry manure @ 5 t/ha (T4), NPK + Biofertilizer @ 1 kg/ha (T5), NPK + FYM + Biofertilizer @ 1kg/ha (T6), NPK + Vermicompost + Biofertilizer @ 1 kg/ha (T7), NPK + Poultry manure + Biofertilizer @ 1kg/ha (T8). Observations were recorded for various yield attributes and yield.

RESULTS AND DISCUSSION

The consequences received from the present investigation had been discussed inside the following sub heads:

GROWTH STUDIES

Growth become measured in phrases of peak of plant, range of tillers, and dry be counted accumulation in step with plant and results are provided beneath.

Plant Length (cm)

The plant height become recorded at 30, 60 DAT and at harvest. The peak was now not effected extensively by specific treatments at 30, 60 DAT. At harvest stage diverse remedies influenced the plant height considerably. Application of NPK + FYM + Biofertilizer @ 1kg/ha at 30 DAT (34.97 cm) recorded maximum plant height, being a par with NPK alone (32.24cm) at 30DAT became significantly superior to all treatments. The application of one hundred% NPK by myself resulted substantially discount in plant height in evaluation to the NPK + FYM + Biofertilizer @ 1 kg/ha at 30, 60 DAT (34.97, 63.21 cm) and at harvest. Minimum plant height is 68.77 cm become recorded with manage plot. All the treatments are superior than manipulate remedy (Sri ranjitha et al 2013).

Number of tillers according to plant

The records quantity of tillers have been recorded at 30, 60 DAT and at harvest. Number of tillers was counted at specific crop growth tiers and it is able to be concluded variety of tillers extended from 30 DAT and reached most at 60-75 DAT and commenced declining thereafter. At 30 & 60 DAT highest quantity of tillers were recorded within the remedy of NPK + FYM + Biofertilizer @ 1 kg/ha at 30 DAT (nine.36, 25.98) which become extensively at par with NPK on my own (8). Minimum quantity of tillers changed into seen on top of things remedy.

Dry Matter Accumulation (g)

Rate of dry matter accumulation accelerated gradually with age of crop, most fee being recorded at 60 DAT and

harvest (table 3). Date found out that dry be counted accumulation at 30 DAT maximum dry count number accumulation (11.77 g) in NPK + FYM + Biofertilizer @ 1 kg/ha which was statistically at par with NPK on my own (9.73 g) remedy. At 60DAT highest dry remember accumulation was recorded in NPK + FYM + Vermicompost @ 1kg/ha (68.32 g). At harvest highest dry rely accumulation become recorded in NPK + FYM + Biofertilizer @ 1 kg/ha (279.46 g). Minimum dry matter accumulation became recorded on top of things treatment (227.13 g).

YIELD ATTRIBUTES

Yield attributes like panicle duration(cm), variety of grains per panicle, Test weight (one thousand grains weight) are provided in desk four. The appreciably maximum duration of panicle become recorded within the treatment NPK + FYM + Biofertilizer @ 1kg/ha (21 cm) which was statistically at par with NPK by myself (20.42 cm). Minimum panicle period became recorded on top of things remedy (18.42 cm). The range of grains per panicle turned into significantly accelerated with boom in nutrient and satisfactory end result became obtained wherein the mixtures of both natural and inorganic resources had been implemented. Maximum number of grains have been obtained in NPK + FYM + Biofertilizer @ 1 kg/ha (192.43) which changed into statistically at par with NPK on my own (185.35). Minimum grains had been recorded on top of things treatment (149.75). Test weight becomes notably increased due to utility of numerous organic and inorganic assets with their aggregate. The maximum check weight became recorded below the remedy of NPK + FYM + Biofertilizer @ 1 kg/ha (17.93 g) which turned into statistically at par with NPK alone (15.00 g) observed with the aid of last remedies. Minimum test weight was located on top of things remedy (14.05 g). Similar consequences became recorded via Singh and Singh 2008.

YIELD

Grain Yield, Straw yield, Biological Yield and Harvest index were provided and in desk five and have been explained beneath. The most yields are discovered inside the treatment NPK + FYM + Biofertilizer @ 1kg/ha (4973 kg) which became statistically par with NPK alone (3872 kg) followed through last treatments with natural and inorganic combos. Minimum grain yield changed into recorded under the manipulate treatment (2975 kg). The most straw yield became recorded from the remedy of NPK + FYM + Biofertilizer @ 1kg/ha (5981 kg) which turned into statistically par with NPK alone (4879 kg) treatment. Remaining treatments with organic and inorganic aggregate offers excessive straw yield. Minimum straw yield become recorded on top of things remedy (3473 kg). The maximum organic yield was recorded in treatment NPK + FYM + Biofertilizer @ 1 kg/ha (10954 kg) which changed into statistically par with NPK by myself remedy (8751 kg). Even as the other treatments with natural and inorganic combinations are superior in result. Minimum biological yield was recorded in control treatment (6448 kg). The harvest index of remedy NPK + FYM + Biofertilizer @ 1 kg/ha (45.39) which was superior to other treatments. Minimum harvest

index become recorded in control remedy (46.13). Similar end changed into made via singh *et al.* 2004.

NPK UPTAKE %

Application of NPK +FYM +Bio fertilizer @ 1kg/ha (61.34 kg) recorded highest nitrogen uptake which statistically par with NPK by myself remedy (47.63). Minimum nitrogen uptake becomes recorded in the control treatment (43.63). In case of straw most turned into recorded within the treatment NPK + FYM + Bio fertilizer @ 1kg/ha (14.93) which became statistically par with NPK by myself treatment (11.74). Minimum nitrogen uptake in straw becomes recorded on top of things remedy (10.97). Better root proliferation made it feasible for plant to explore maximum area in soil for nutrient absorption, which changed into intended by way of Kutharia 1997 and Singh. 1999.

The records pertaining in table 6 the highest uptake of phosphorus in grain as well as in straw was recorded in NPK +FYM + Biofertilizer @ 1kg/ha (11.39, 6.26) which changed into statistically par with NPK by myself remedy (8.93, 4.12). Minimum phosphorus uptake turned into located on top of things treatment (7.11, 3.28). Minimum uptake became found in NPK alone remedy and manage treatment equal end result become found via Yadav *et al.* 2005.

Potassium uptake was more within the straw than grain yield. It was notably accelerated due to application of various remedies. Maximum potassium uptake in straw and grain were recorded in NPK + FYM + Biofertilizer @ 1 kg/ha (14.79, 84.19) which become statistically par with NPK on my own remedy (11.98, 69.10) both in grain and straw. However minimal uptake in straw and grain was discovered in control treatment (10.86, 66.43). Similar result turned into discovered by Kumar *et al.*, 2014.

Combined NPK uptake (kg/ha)

The records on overall uptake NPK given in table 7 the facts discovered that the mixed uptake of NPK changed into drastically affected because of numerous treatments. The treatment with utility of NPK + FYM + Biofertilizer @ 1 kg/ha (192.90 kg) resulted in highest general uptake of NPK even though it's far par with NPK on my own treatment (153.50 kg). The percent boom in combined

NPK uptake by means of all of the organic and inorganic remedies. However minimum NPK uptake turned into observed in control remedy (142.28 kg). Such end result becomes stated via Mehedi *et al.*, 2011.

ECONOMICS

The records turned into presented inside the table four.8 indicated that the highest cost of cultivation become determined inside the remedy NPK +Vermicompost + Biofertilizer @ 1kg/ha (60070) accompanied by means of all organic and inorganic combination remedies because of highly-priced chemical fertilizers and organic manures. The lowest price of cultivation was located in control remedy (18290). The facts turned into provided in the desk four. Eight indicated that the very best gross go back became acquired within the treatment NPK + FYM + Biofertilizer @ 1 kg/ha (84298) followed through NPK + Vermicompost + Biofertilizer @ 1kg/ha (81313). The lowest gross go back became recorded in control remedy (30139). The statistics turned into offered in the desk four.8 indicated that maximum internet go back was recorded beneath the treatment NPK +FYM + Biofertilizer @ 1 kg/ha (52878) accompanied by way of NPK + FYM (48911). Minimum was determined within the control remedy (11849).

CONCLUSION

Studies were carried out for three hundred and sixty five days during 2016 at the research farm of Doon (PG) College of Agriculture and Allied Sciences, Rampur, Dehradun, Uttarakhand with principal goal to study the impact of manures and fertilizers and their aggregate on growth and yield of rice. Based at the yr studies on Effect of Integrated Nutrient Management of Rice (*Oryza sativa* L.) Under System of Rice Intensification on Growth and Yield, it could be concluded that integration of NPK + FYM +Biofertilizer @ 1kg/ha ended in higher productivity in terms of increase, yield attributes, grain, straw and organic yield. Similar sample changed into accompanied in NPK uptake via rice crop. Based on three hundred and sixty five days observation maximum net return and advantage cost ratio have been located inside the treatment NPK + FYM + biofertilizer @ 1 kg/ha.

TABLE 1: Plant height as influenced by integrated nutrient management practices of crop growth

TREATMENTS	Plant height (cm)		
	30 DAT	60 DAT	Harvest
Control	30.41	57.43	68.67
NPK (RDF)	32.24	60.99	76.30
NPK + FYM @ 12.5 t/ha	34.79	62.32	88.73
NPK + Vermi compost @ 5 t/ha	33.26	61.26	86.47
NPK + Poultry Manure @ 5 t/ha	33.10	61.09	85.29
NPK + Bio Fertilizer @ 1 kg/ha	32.79	60.98	80.43
NPK + FYM + Bio fertilizer @ 1 kg/ha	34.97	63.21	92.67
NPK + Vermi compost + Bio fertilizer	33.97	62.85	90.83
NPK + Poultry + BIO fertilizer	33.27	62.79	89.94
S.Em ±	0.45	0.58	2.61
C.D at 5%	0.95	1.22	5.53

TABLE 2: Number of tillers per hill as influenced by integrated nutrient management practices of crop growth

TREATMENTS	Number of tillers/hill		
	30 DAT	60 DAT	Harvest
Control	7.36	15.03	13.56
NPK (RDF)	8.00	23.92	14.30
NPK + FYM @ 12.5 t/ha	8.79	24.13	16.79
NPK + Vermi compost @ 5 t/ha	8.43	24.23	16.15
NPK + Poultry Manure @ 5 t/ha	8.20	23.32	15.88
NPK + Bio Fertilizer @ 1 kg/ha	8.07	22.19	15.43
NPK + FYM + Bio fertilizer @ 1 kg/ha	9.36	25.98	18.70
NPK + Vermi compost + Bio fertilizer	9.12	24.97	17.95
NPK + Poultry + BIO fertilizer	8.98	24.72	17.60
S.Em ±	0.21	1.07	0.56
C.D at 5%	0.44	2.26	13.90

TABLE 3: Plant dry matter as influenced by integrated nutrient management practices of crop growth

TREATMENTS	Plant dry matter (g)		
	30 DAT	60 DAT	Harvest DAT
Control	8.56	35.19	227.13
NPK (RDF)	9.73	60.22	230.73
NPK + FYM @ 12.5 t/ha	10.94	65.47	259.24
NPK + Vermi compost @ 5 t/ha	10.72	63.78	244.78
NPK + Poultry Manure @ 5 t/ha	9.97	62.69	239.46
NPK + Bio Fertilizer @ 1 kg/ha	10.14	61.46	233.85
NPK + FYM + Bio fertilizer @ 1 kg/ha	11.77	68.32	279.46
NPK + Vermi compost + Bio fertilizer	11.21	67.46	268.33
NPK + Poultry + BIO fertilizer	10.98	66.01	260.79
S.Em ±	0.31	3.36	6.11
C.D at 5%	0.65	7.12	12.95

TABLE 4: Yield attributes as influenced by integrated nutrient management practices of crop growth

Treatments	Yield attributes		
	Panicle length (cm)	No.of grains/panicle	1000grain weight(g)
Control	18.42	149.75	14.05
NPK (RDF)	20.42	185.35	15.00
NPK + FYM @ 12.5 t/ha	22.53	190.32	16.31
NPK + Vermi compost @ 5 t/ha	21.43	188.76	15.75
NPK + Poultry Manure @ 5 t/ha	20.98	187.32	15.19
NPK + Bio Fertilizer @ 1 kg/ha	21.00	186.47	15.07
NPK + FYM + Bio fertilizer @ 1 kg/ha	23.45	192.43	17.93
NPK + Vermi compost + Bio fertilizer	22.97	111.46	16.97
NPK + Poultry + BIO fertilizer	22.11	190.23	16.75
S.Em ±	0.50	9.14	0.40
C.D at 5%	1.06	19.37	0.84

Table: 5: Grain, straw, Biological yields and Harvest index as influenced by integrated nutrient management practices of Crop growth

Treatments	Grain	Straw	Biological Yield kg/ha	harvest index %
	Yield Kg/ha	Yield kg/ha		
Control	2975	3473	6448	46.13
NPK (RDF)	3872	4879	8751	44.24
NPK + FYM @ 12.5 t/ha	4276	5560	9836	43.47
NPK + Vermi compost @ 5 t/ha	4197	5260	9457	44.37
NPK + Poultry Manure @ 5 t/ha	4093	5103	9196	44.50
NPK + Bio Fertilizer @ 1 kg/ha	4001	5014	9015	44.38
NPK + FYM + Bio fertilizer @ 1 kg/ha	4973	5981	10954	45.39
NPK + Vermi compost + Bio fertilizer	4806	5742	10548	45.56
NPK + Poultry + BIO fertilizer	4604	5611	10215	45.07
S.Em ±	196.95	245.28	439.57	0.27
C.D at 5%	NS	NS	NS	0.57

TABLE 6: NPK (%) uptake as influenced by integrated nutrient management practices of crop growth

Treatments	Nitrogen uptake		Phosphorus uptake		Potassium uptake	
	Grain	Straw	Grain	Straw	Grain	Straw
Control	43.63	10.97	7.11	3.28	10.86	66.43
NPK (RDF)	47.63	11.74	8.93	4.12	11.98	69.10
NPK + FYM @ 12.5 t/ha	48.98	12.32	9.36	4.99	12.38	72.10
NPK + Vermi compost @ 5 t/ha	48.21	11.98	9.01	4.78	12.13	71.00
NPK + Poultry Manure @ 5 t/ha	47.86	11.32	9.12	4.98	11.99	70.13
NPK + Bio Fertilizer @ 1 kg/ha	48.00	12.00	8.89	4.06	11.97	71.13
NPK + FYM + Bio fertilizer @ 1 kg/ha	61.34	14.93	11.39	6.26	14.79	84.19
NPK + Vermi compost + Bio fertilizer	59.73	13.87	10.73	5.82	14.30	80.75
NPK + Poultry + BIO fertilizer	58.56	13.21	10.11	5.26	13.29	78.11
S.Em ±	2.15	0.42	0.41	0.30	0.43	2.03
C.D at 5%	4.55	0.89	0.87	0.63	0.91	4.30

TABLE 7: Combined NPK uptake (kg/ha) as influenced by integrated nutrient management practices of crop growth

Treatments	Combined NPK uptake (kg/ha)
Control	142.28
NPK (RDF)	153.50
NPK + FYM @ 12.5 t/ha	160.13
NPK + Vermi compost @ 5 t/ha	157.11
NPK + Poultry Manure @ 5 t/ha	154.40
NPK + Bio Fertilizer @ 1 kg/ha	156.05
NPK + FYM + Bio fertilizer @ 1 kg/ha	192.90
NPK + Vermi compost + Bio fertilizer	185.20
NPK + Poultry + BIO fertilizer	178.54
S.Em ±	5.64
C.D at 5%	11.95

TABLE 8: Economics as influenced by integrated nutrient management practices of crop growth (/ha)

Treatments	Economics (/ha)		
	Cost of cultivation (/ha)	Gross return (/ha)	Net return (/ha)
Control	18290	30139	11849
NPK (RDF)	19970	50136	30166
NPK + FYM @ 12.5 t/ha	31220	80131	48911
NPK + Vermi compost @ 5 t/ha	59870	79298	19428
NPK + Poultry Manure @ 5 t/ha	43970	72000	28030
NPK + Bio Fertilizer @ 1 kg/ha	20170	50200	30030
NPK + FYM + Bio fertilizer @ 1 kg/ha	31420	84298	52878
NPK + Vermi compost + Bio fertilizer	60070	81313	21243
NPK + Poultry + Biofertilizer	44170	80542	36372
S.Em ±	-	-	-
C.D at 5%	-	-	-

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