Indian Council of Agricultural Research

Proforma for Certifying a Technology

Effect of MEGAFOL-Bio-stimulant on crop growth, physiological and biochemical changes, and yield of Rice crop

Submitted by
Dr.R. Mahender Kumar
Principal Scientist & Head, Agronomy

ICAR-Indian Institute of Rice Research
Rajendranagar, Hyderabad-500030, India

Certifying Products/Technologies/Process/Methodology/Model/Protocol/Policy etc.

Item	
1. Name of the product/technology (as defined above)	Effect of MEGAFOL- bio-stimulants on crop growth, physiological and biochemical changes, and yield of Rice crop
2. Name and address of the Institute	ICAR-Indian Institute of Rice Research, Rajendranagar, Hyderabad – 500030, Telangana
3. Institution(s) responsible for developing/evaluating/identifying including collaborators, if any	Valagro Bio Sciences, Ltd., The Platina Building, A-904, 9tj floor, Gachibowli, Serilingampalli, Hyderabad-500032.
4. Source of product/technology (Research Project/Student Research/Any other ad-hoc research study)	Research Project
5. Period of development/evaluation/validation	2021-2022
6. Developers (Lead and Associates)	Dr. R. Mahender Kumar
7. Summary of the product/technology (maximum of 200 words)	According to the FAO report (Food and Agriculture Organization), global rice requirement by 2025 will be 800 m t. At the moment, rice production is less than 600 m t and an additional 200 m t is needed, which has to be produced by increasing productivity per unit area against the diminishing resources. To meet our needed yield without affecting the productivity of rice has to be achieved through the proper utilization of resources. The use of biostimulants is an agronomic tool to improve plant tolerance to abiotic stress in plants. Biostimulants have much potential to improve crop production through enhanced yields, grain quality, and increased sustainability of agronomic production systems, particularly in relation to nutrient management. However, there is great variability in the efficacy of biostimulants and a limited understanding of the mechanisms responsible in field-tested scenarios where differences are observed. These unknown mechanisms may align with the recognized soil health indicators,

	providing opportunities for unrealized biostimulant potential beyond crop growth and development. This review aims to identify the predominant types of crop biostimulants, the known understandings of their modes of action, and examples of their current field efficacy with an outlook for their future. The focus on fertilizer recovery potential is currently the leading research strategy for biostimulant use in row crop systems, with growing attention to increasing grain yield, which is often a result of more efficient nutrient use. While many biostimulants are targeted for application to row crops for increased productivity, many products achieve these responses through impacts on soils and the biology of the root zone. A closer evaluation of biostimulant effects on soil quality and biological indicators may reveal previously unknown benefits to their application. With greater government and public awareness of agronomic practices and their influence on water quality and nutrient management, the use of biostimulants as a solution to more sustainable practices and improved soil quality provides a viable option even in the absence of measurable yield increases. Grain yield due to seaweed bio-stimulants application varied from 5.31 to 5.58 t/ha and significantly increased over recommended dose of fertilizer alone (5%). Percent increase of grain yield was 4.15 to 9.14 per cent over recommended dose of fertilizer (Arun et al 2020). The experiment was conducted to study the effect of bio-stimulant MEGAFOL on the yield and yield attributes of transplanted rice in kharif 2021 and rabi 2021-22seasons in randomised block design with nine replications. The MEGAFOL was applied as foliar spray three times at tillering, panicle initiation and booting stage. The yield attributes and yield was significantly superior in MEGAFOL treated plots over control. The average percentage grain yield increase was 10.64 % in T3: Megafol

	2.5L/ha followed by 10.02 % in T4: Megafol 3.0L/ha and 9.10 % in T2: Megafol (2.0L/ha) treatments over control treatment.
8. Is it a new technology? (Yes/No). If no, prove the details of the technology modified	Yes
9. IPR involved, if any (Patent/Copyright/Industrial Design Registration/Variety/Germplasm registration). Provide Filed/Granted number	NA
10. Validation procedure followed (within Institute, collaborators, multilocation/multi-site testing)	Within institute
11. Brief description of research output/technology	

a. **Objective**

- To evaluate and test effect bio-stimulant MEGAFOL on crop growth, physiological and biochemical changes, and yield of Rice crop

b. **Methodology**

The experiment was conducted to study the effect of bio-stimulant MEGAFOL on the yield and yield attributes of transplanted rice in kharif 2021 and rabi 2021-22seasons in randomised block design with nine replications. The MEGAFOL was applied as foliar spray three times at tillering, panicle initiation and booting stage.

c. **Yield attributers & Yield**

Plant height was recorded at 30, 60, 90 days after transplanting and at harvest time and there was no significant difference among four treatments.

Number of tillers per square meter varies at critical stage of growth. Megafol treatments influenced the number of tillers per square meter significantly at 60 DAT, 90 DAT and at harvest stage. Maximum no of tillers was recorded in T4: Megfol 3L/ha (456) followed by T3: Megafol 2.5L/ha (419) and T2: Megafol 2L/ha (324) which contributed for higher yields in treated plots.

The chlorophyll content in plant leaves was recorded by SPAD meter at 30, 60 and 90 DAT and were significant only at 90 DAT. Maximum SPAD readings were recorded in in Megafol treated plots over control. The maximum SPAD value content indicates the higher chlorophyll and photo synthesis.

The mean average effective tillers percentage recorded was 86.1, 88.8 and 87.5in Kharif, Rabi and in Pooled data. It was non-significant over the treatments in both the seasons but significant in pooled data. Higher values for test weight were recorded with T4: Megafol 3L/ha (3.22 g) followed by T3: Megafol 2.5L/ha (3.10 g).

Maximum no of grains per panicles were recorded in T4: Megafol 3L/ha (279) and it was on par with T3: Megafol 2.5L/ha (273).

Treatment with Megafol was significantly contributed to higher grain yield over control plot. Maximum grain yield was recorded in T3: Megafol 2.5L/ha (6.00 t/ha) followed by T4: Megafol 3.0L/ha (5.96 t/ha) and was nearly on par with T2: Megafol 2.0L/ha (5.91 t/ha) whereas the Control treatment recorded 5.42 t/ha.

The average percentage grain yield increase was 10.64 % in T3: Megafol 2.5L/ha followed by 10.02 % in T4: Megafol 3.0L/ha and 9.10 % in T2: Megafol (2.0L/ha) treatments over control treatment.

The mean average straw yield recorded was 6.76, 6.62 and 6.62 t/ha in T4: Megafol 3.0L/ha, T3: Megafol 2.5L/ha and T2: Megafol (2.0L/ha) treatments respectively. The treatments didn't contribute significantly for straw yield. The trend is nealry similar in terms of harvest index values in Megafol treated plots which contributed for higher yield.

d. **Saving of water, labour, time and energy**

Netenergy out was more in Megafol treatments and Energy productivity was more in MEGAFOL treated plots (0.73, 0.73 & 0.74 kg grain / MJ input energy) over control (0.71 kg grain/MJ energy) plots.

Phytotoxicity

Phytotoxicity data was collected before the spay and 5, 10,15 days after spraying. There was no phyto toxicity by abiotic stress symptoms were observed across the Megafol treatments.

e. **Cost effectiveness including B:C ratio**

Cost of cultivation was nearly same in all treated and control plots but the benefit cost ratio was superior in Megafol treated plots (1.62, 1.66 & 1.64) over control (1.47).

f. **Passport data of the product/ technology**

The focus on fertilizer recovery potential is currently the leading research strategy for biostimulant use in row crop systems, with growing attention to increasing grain yield, which is often a result of more efficient nutrient use. While many biostimulants are targeted for application to row crops for increased productivity, many products achieve these responses through impacts on soils and the biology of the root zone. A closer evaluation of biostimulant effects on soil quality and biological indicators may reveal previously unknown benefits to their application. With greater government and public awareness of agronomic practices and their influence on water quality and nutrient management, the use of biostimulants as a solution to more sustainable practices and improved soil quality provides a viable option even in the absence of measurable yield increases. Grain yield due to seaweed bio-stimulants application varied from 5.31 to 5.58 t/ha and significantly increased over recommended dose of fertilizer alone (5%). Percent increase of grain yield was 4.15 to 9.14 per cent over recommended dose of fertilizer (Arun et al 2020). The experiment was conducted to study the effect of bio-stimulant MEGAFOL on the yield and yield attributes of transplanted rice.

12. Details of relevant data generated during the development/validation	

Table. Phytotoxicity by abiotic stress in rice as influenced by application of MEGAFOL (0-9 scale)

Treatement		Days after spray				
		Before	5	10	15	20
MEGAFOL	control	0	0	0	0	0
	2L/ha	0	0	0	0	0
	2.5L/ha	0	0	0	0	0
	3L/ha	0	0	0	0	0

Table. Influence of Megafol treatments on plant height at critical stage of crop growth

Treatment		Plant height (cm)			
		30 DAT	60 DAT	90 DAT	Harvest
MEGAFOL	Control (100% RDF)	46.89	59.17	94.13	91.82
	2L/ha	46.02	59.54	94.13	91.06
	2.5L/ha	43.57	57.89	93.66	96.07
	3L/ha	45.16	56.2	95.23	94.45
Exp. mean		45.41	58.2	94.28	93.35
CD(0.05)		3.51	5.4	2.82	3.98
CV		6.28	7.55	2.43	3.46
res1(t)		NS	NS	NS	NS

Table . Influence of Megafol treatments on No. of tillers at critical stage of crop growth

Treatment		No. of tillers/m^2			
		30 DAT	60 DAT	90 DAT	Harvest
MEGAFOL	Control (100% RDF)	232	236	237	279
	2L/ha	243	281	267	324
	2.5L/ha	244	352	311	419
	3L/ha	260	384	347	456
Exp. mean		326	245	313	290
CD(0.05)		60	45	27.31	52.67
CV		14.95	14.95	7.08	14.75
res1(t)		NS	NS	**	**

Table. Influence of Megafol treatments on SPAD at critical stage of crop growth

Treatment		SPAD		
		30 DAT	60 DAT	90 DAT
MEGAFOL	Control (100% RDF)	32.44	35.36	38.62
	2L/ha	33.56	36.48	40.81
	2.5L/ha	35.03	40.08	41.27
	3L/ha	33.8	37.35	44.47
Exp. mean		33.71	37.32	41.29
CD(0.05)		3.48	3.62	2.05
CV		8.39	7.89	4.04
res1(t)		NS	NS	**

Table . Influence of Megafol treatments on yield & yield attributes

Treatment		No. of panicles/ m2	Panicle weight (g)	Test weight (g)	No of grains /panicle	Grain Yield (t/ha)	Straw Yield (t/ha)	Harvest Index (%)	% Grain Yield Increase over Control
MEGAFOL	Control (100% RDF)	352	4.12	2.89	250	5.42	6.45	45.72	
	2L/ha	418	4.6	3.06	271	5.91	6.62	47.16	**9.10**
	2.5L/ha	553	4.63	3.1	273	6.00	6.62	47.54	**10.64**
	3L/ha	596	4.77	3.22	279	5.96	6.76	46.86	**10.02**
Exp. mean		480	4.53	3.07	268	5.82	6.61	46.82	
CD(0.05)		38.31	0.3	0.29	22.24	0.32	0.46	1.08	
CV		6.49	5.42	7.77	6.74	4.44	5.6	1.87	
res1(t)		**	**	NS	NS	**	NS	*	

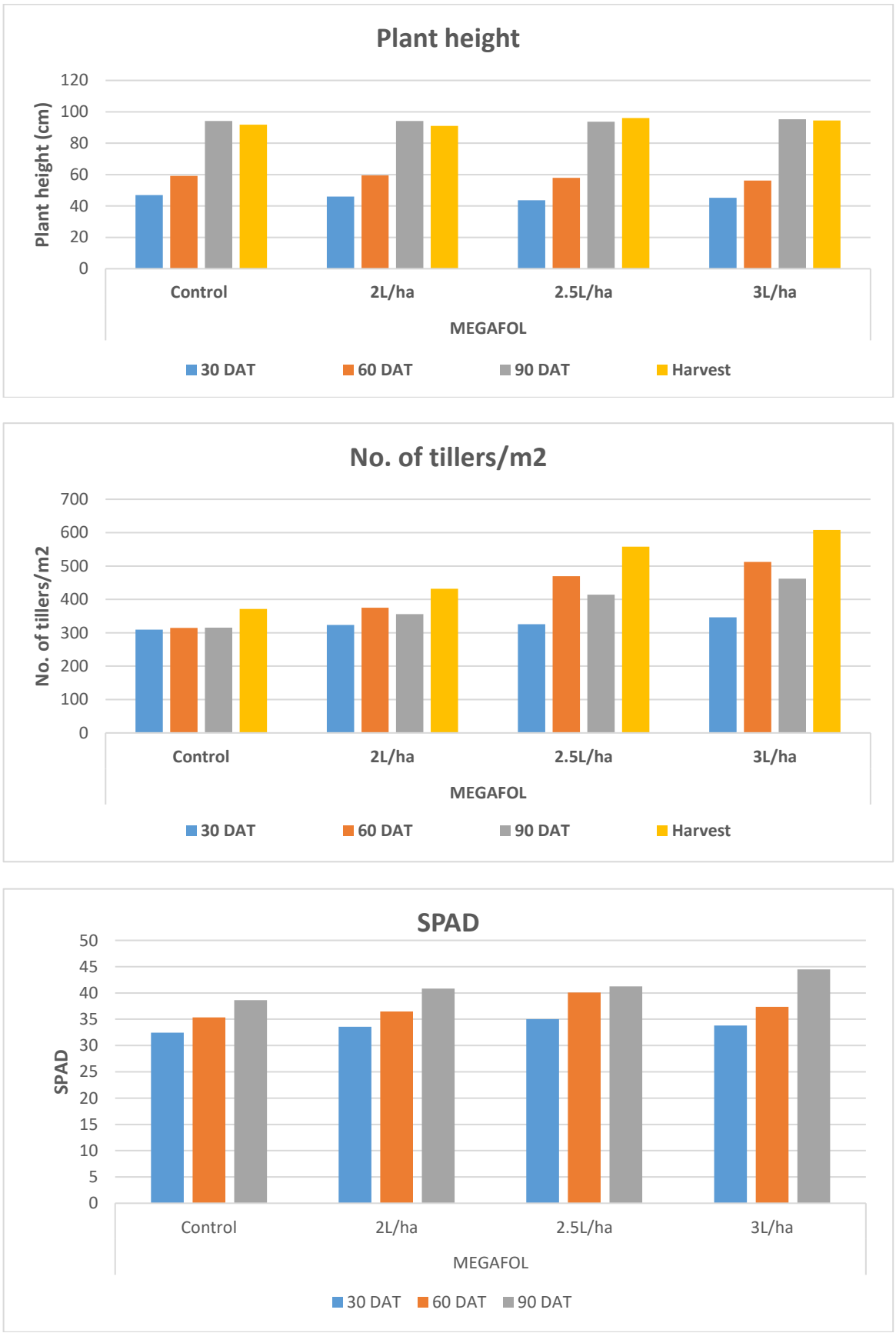


Fig. Growth parameters as influenced by Megafol treatments

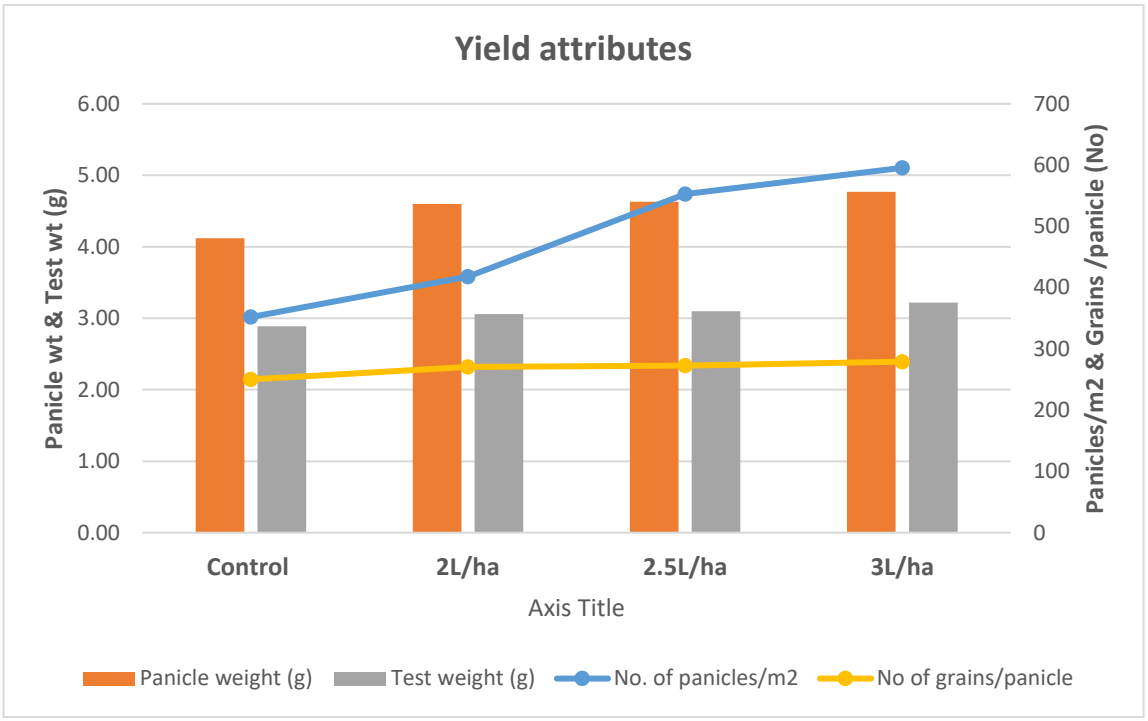


Fig. Yield attributes influenced by Megafol treatments

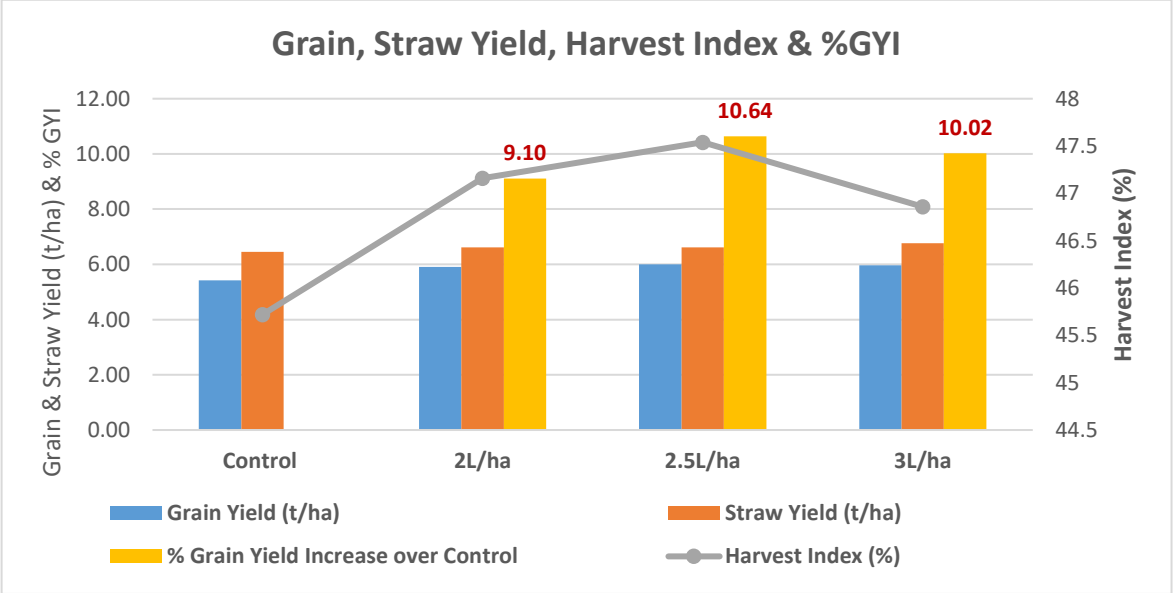


Fig. Grain, Straw yield & % grain yield increase over control as influenced by Megafol treatments

13. Proposed stakeholders	Transplanted rice farmers
14. Commercial potential, if any	Can be commercialized
15. Publications/photos/video clipping, if any	

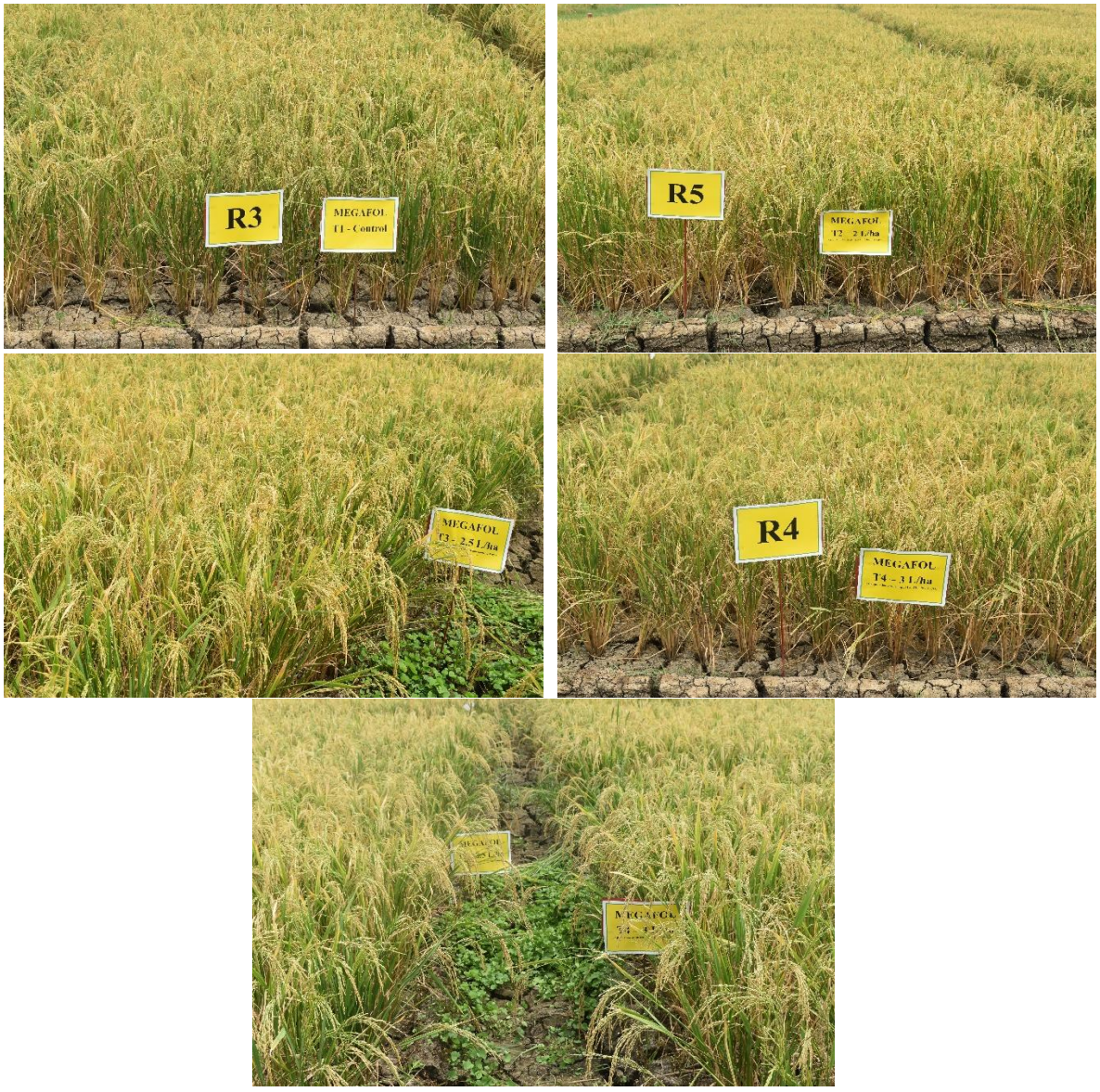
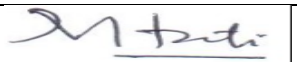
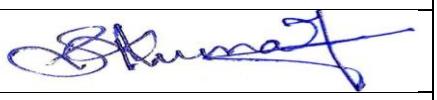


Plate 1. Megafol experimental plot at harvest stage

- Use of Megafol product significantly enhanced the growth parameters and grain yield
- Among the treatments T4 (Megafol 3.0L/ha) found superior with 10.62% followed by T3 (Megafol 2.5L/ha) 10.02 % grain yield increase over control found promising in terms of grain yield.
- Megafol @ 2.5L/ha can be recommended as an ideal dosage for enhancing the growth and yield of rice crop.

Declaration: I/we hereby undertake that the above information is correct. All scientists in the development of this research output have been included in the list of associates. The research output does not involve any third party IPR.

1. Name and signature of all the developers

Name	**Developer / co-developer / Collaborator**	**Signature**
Dr. R.Mahender Kumar	Developer	
Dr. B.Sreedevi	Co-developer	
Dr. Mangaldeep Tuti	Co-developer	
Dr. S. Vijaya Kumar	Co-developer	
Dr. K. Surekha	Co-developer	
Dr. M.B.B. Prasad Babu	Co-developer	
Dr. V. Manasa	Co-developer	
Dr. Prakasam	Co-developer	
Dr. Ch. Padmavathi	Co-developer	
Dr. Senguttuvelu	Co-developer	
Dr. D. Srinivas	Co-developer	

2. Recommendations of the Head of Division

3. Recommendations of ITMC/PME

4. Recommendations o DIRECTOR

5. Recommendations of SMD