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Biological effect of potash on yield and yield attributes of groundnut crop

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Abstract
A research was conducted in Dept. of Plant Physiology at College of Agriculture, OUAT, Bhubaneswar in order to study the Biological Effect of Potash on Yield and Yield Attributes of Groundnut Crop in Coastal region of Odisha. Here the Researchers were very optimistic to study the impact and effect of Potash which is a Macronutrient triggered the Root growth, Pod growth and as a whole Oil Content in Oilseed crop. The research was made in 2014-15.

Keywords: Biological effect, potash, yield attributes, groundnut crop

Introduction
Ground nut is the major Oil Seed Crop grown in Odisha. This crop is very popular in Coastal belt due to highest consumption of Groundnut. In order to seem this importance OUAT has made research on Groundnut in AICRIP on Groundnut in association with ICAR, Govt. Of India. For pod growth and during critical stages of groundnut potash is required.

Materials and methods
The Researchers were followed the Research Design of Randomized Block Design (RBD) in order to get error free and concrete results.10 Replications had been made in order to maintain clarity. One Control Plot and Rest treated plot were used for making successful experiment. A Concrete Farm Plan and Calendar was followed strictly by practising suitable Package of practices and intercultural operation from time to time under the guidance of Plant Physiologist, Agronomist and Soil Scientists.

Result and discussion
After going through various experiments in Field the Researchers were able find the following attributes of Results elaborated as below:-

CGR, RGR, NAR and LAR
Crop growth rate (CGR), Relative growth rate (RGR) Net assimilation rate (NAR) and Leaf area ratio (LAR) determined between 30 and 60 DAS were depicted in table-7.
CGR varied among the treatments ranging a minimum of 15.5 to a maximum of 25.9 g/m^2/day. Among the treatments the highest CGR was recorded in (T_7) where groundnut grown with 60 kg K/ha which applied in split doses and the lowest CGR was recorded in crop grown without any fertilizer (T_1). An increase in CGR was also observed with increase in K application but significant increase in CGR was recorded at 60 kg K/ha (T_7) and 80kg K/ha (T_8) which were found at par but differed significantly from T_1, T_2, T_3, and T_4. Significantly higher CGR were recorded in groundnut crop applied with K in split doses as compared to its single application only at the time of sowing.
RGR increased with increase in the level of potash application up to 60 kg/ha but beyond this level no significant change in RGR was noticed. The lowest RGR (34.66 mg/g/day) was recorded in groundnut crop grown without any fertilizer (T_1) and the highest RGR (45.52 mg/g day) was recorded in plants applied with 60 kg K/ha in split doses (T_7). Split application of potash at sowing and flowering in groundnut crop registered higher RGR than its single dose application at sowing. NAR varied among the treatments ranging a minimum of 1.242 mg/cm2/day in T_2 to a maximum value of 1.636 mg/cm2/day in (T7). Increased application of potash level up to 60 kg K/ha increased NAR significantly but beyond this level there was no significant change in NAR was observed. Higher values of NAR were recorded in plants applied with K in split doses than single dose application.

LAR varied in the range between 24.3 to 28.46 cm^2/g among the treatments. Application of K though increased LAR but no significant difference was observed among the treatments.

Table 1: Effect of levels and time of potash application on Crop growth rate (CGR), Relative growth rate (RGR), Net assimilation rate (NAR) and Leaf area ratio (LAR) during 30-60 DAS.

Treatments	CGR (g/m^2/day)	RGR (mg/g/day)	NAR (mg/cm^2/day)	LAR (cm^2/gm)
	30-60 DAS	30-60DAS	30-60DAS	30-60DAS
T_1	15.5	34.66	1.795	19.305
T_2	16.19	35.36	1.242	28.466
T_3	18.7	38.06	1.410	26.980
T_4	18.53	35.82	1.313	27.274
T_5	22.60	39.21	1.527	25.669
T_6	23.43	39.23	1.494	26.244
T_7	25.90	45.52	1.636	27.996
T_8	24.02	41.93	1.576	26.596
SEM	1.272	1.301	0.184	2.11
CD 5%	3.857	3.89	NS	NS

Chlorophyll index, CSI and MSI

Chlorophyll index, chlorophyll stability index (CSI) and membrane stability index (MSI) recorded at 45 and 60 DAS were presented in table-8. Data revealed that higher chlorophyll index recorded at 60 DAS than 45 DAS where as CSI and MSI decreased with progress in age of the crop.

Variation in chlorophyll index among the treatments noticed at both the growth stages. Chlorophyll index increased with increase in the level of K application but significant increase was recorded in groundnut crop supplied with 60 and 80 kg K/ha. The highest chlorophyll index was 14.4 and 17.3 was recorded at 45 and 60 DAS respectively in groundnut crop applied with 80 kg K/ha in two split (T_8) and the lowest value of chlorophyll index 7.3 and 10.3 recorded at 45 and 60 DAS respectively in crop grown without any fertilizer (T_1). Split application of K increased chlorophyll index at both the stages of growth but significant difference was not found between application of 60 kg and 80 kg K/ha.

Difference in CSI was noticed among the treatments at both stages varying from 47.34 to 72.69% at 45 DAS and 45.2 to 69.7% at 60 DAS. The lowest value was recorded for plants grown without K (T_1) and the highest value was recorded for plants grown with 80kg K/ha applied in two splits (T_8). CSI increased with increase in the level of K application but significant increase was noticed only at 60 kg K/ha (T_7) and 80 kg K/ha (T_8) when applied in split doses. However no significant difference was observed between T_7 and T_8 with respect to CSI.

Table 2: Effect of levels and time of potash application on Chlorophyll content, Chlorophyll stability index (CSI) and Membrane Stability index (MSI) of groundnut.

Treatments	Chlorophyll index (SPAD)		CSI (%)		MSI (%)	
	45 DAS	60 DAS	45 DAS	60 DAS	45 DAS	60 DAS
T_1	7.3	10.3	47.34	45.2	64.38	15.4
T_2	7.8	11.2	49.21	47.5	66.21	19.8
T_3	9.2	13.5	51.20	49.2	67.97	21.2
T_4	10.5	14.2	51.96	48.8	69.45	22.4
T_5	11.5	15.6	60.98	57.5	71.30	24.3
T_6	12.3	16.7	61.88	58.3	71.98	23.8
T_7	12.2	16.6	72.35	69.4	72.55	28.4
T_8	14.4	17.3	72.69	69.7	73.22	34.2
SEM	1.0	1.83	5.75	5.08	2.541	2.976
CD (5%)	3.0	5.5	17.2	15.2	7.60	8.92

MSI differed among the treatments recorded at 45 and 60 DAS. MSI varied in the range of 64.4 to 73.2% and 15.4 to 34.2% at 45 and 60 DAS respectively. Among the treatments the highest MSI was recorded for plants grown with 80 kg K/ha in split application (T_8) and the lowest value were recorded in plants grown without K (T_1) at both 45 and 60 DAS. Increase in MSI was noticed with increase in the level of K application but significant increase was recorded only when 60 kg K/ha (T_7) and 80 kg K/ha (T_8) was used in split doses. However no significant difference was marked between T_7 and T_8.

WP, MC, RWC, RWD

WP, MC, RWC and RWD determined at 45 and60 DAS (Table-10) indicated that irrespective of treatments the values of these traits were relatively higher at 45 DAS compared to 60 DAS except RWD which was higher at 60 DAS than that of 45 DAS.

Leaf water potential (WP) varied among the treatments. The highest water potential was recorded in T_8 (-1.19 and -1.37 Mpa) at 45 and 60 DAS respectively and the lowest in T_1 (-2.79 and -2.88 MPa) at 45 and 60 DAS respectively. Water potential of groundnut leaf increased with increase in K application rate but significant increase was recorded in crop applied with K at the rate of 60kg/ha in split (T_7) and 80 kg /ha in split (T_8) over control. However no significant difference was observed between T_7 and $T_8$with respect to leaf water potential.

Moisture content (MC) of leaf estimated at 45 and 60 DAS varied among the treatments which ranged 80.60 to 85.30 % at 45 DAS and 79.9 to 84.9% at 60 DAS. Among the treatments the highest MC was recorded in T_8 and the lowest in T_1. Moisture content increased with increase in K application to the crop but significant increased over control was recorded when K applied in split at 40 kg/ha (T_6), 60 kg/ha (T_7) and 80 kg/ha (T_8). However no significant

difference was noticed among these three treatments pertaining to MC of leaf.

RWC measured at 45 and 60 DAS showed similar trend as MC of leaf. The highest RWC (95 and 91.5 %) was recorded in T_8 and the lowest (91.3 and 85.6%) was recorded in T_1 at 45 and 60 DAS respectively. Increased in RWC of leaf was noticed with increased application K to the crop and significant increased over control was recorded.

Table 3: Effect of levels and time of potash application on Water potential (WP) and Moisture content (MC), Relative water content (RWC), Relative water deficit (RWD)

Treatments	WP (Mpa)		MC (%)		RWC (%)		RWD (%)	
	45 DAS	60 DAS	45 DAS	60 DAS	45 DAS	60 DAS	45 DAS	60 DAS
T_1	-2.79	-2.88	80.60	79.95	91.31	85.66	9.69	14.34
T_2	-2.47	-2.56	81.43	80.55	91.63	86.22	9.96	13.78
T_3	-2.28	-2.33	81.68	80.69	92.25	87.54	7.75	12.46
T_4	-2.02	-2.16	82.39	81.44	92.46	87.86	7.54	12.14
T_5	-1.92	-2.02	83.33	82.95	92.69	88.72	7.31	11.28
T_6	-1.76	-1.89	84.52	83.98	93.12	89.10	6.88	10.9
T_7	-1.23	-1.55	85.24	84.33	94.26	90.32	5.74	9.68
T_8	-1.19	-1.37	85.32	84.96	95.01	91.54	4.99	8.46
SEM	0.34	0.38	1.31	1.34	0.97	1.45	0.49	0.73
CD 5%	1.02	1.16	3.92	4.02	2.91	4.35	1.49	2.24

Table 4: Effect of levels and time of potash application on Nitrate reductase activity (NRA) and Proline content of groundnut

Treatments	NRA(µgNO2/g fresh wt/hour)		Proline content (µg/g of fresh weight)	
	45 DAS	60 DAS	45 DAS	60 DAS
T_1	15.31	12.55	68.324	50.6
T_2	17.99	14.21	79.216	71.2
T_3	19.36	16.25	81.459	73.5
T_4	23.54	22.22	82.654	75.4
T_5	25.65	23.17	93.291	81.1
T_6	28.37	26.44	98.414	89.2
T_7	31.92	29.89	101.205	98.9
T_8	32.11	30.06	102.221	99.6
SEM	3.210	3.478	9.762	8.260
CD (5%)	9.6	10.4	29.19	24.7

when K was applied in split at the rate of 60 kg/ha (T_7) and 80 kg K/ha (T_8). However, no significant difference in RWC was marked between T_7 and T_8.

RWD showed an opposite trend compared to MC and RWC. It was reduced in leaf with application of K to the crop. Significant reduction in RWD was recorded in crop applied up to 80 kg K/ha over control. Split application of K at sowing and flowering recorded significant reduction in RWD over single application.

Summery and Conclusion

A field experiment was conducted to study the effect of potash on growth yield and drought tolerance in groundnut during rabi-summer season 2014-2015 at the central farm under AICRP on groundnut, Department of Agronomy, Central farm, OUAT, Bhubaneswar and the physiological studies were carried out in Department of Plant physiology.

A perusal of findings of present experiment revealed following trend.

- CGR, RGR, NAR and LAR considered the most important growth trait showed variation among the treatments. The lowest value of CGR, RGR and NAR was registered in control (T1) while the highest in T7 followed by T8. These traits were increased with increase in the level of K application but beyond 60 kg/ha no significant difference was noticed. Split application in enhancing CGR, RGR and NAR in groundnut crop whereas LAR did not show significant difference among the treatments.
- Variation in CI and CSI was noticed among the treatments estimated at both 45 and 60 DAS. The lowest value was recorded in plants grown without K (T1) and the highest in T8. Both CI and CSI increased with increase in the level of K but significant increase was noticed in T7 and T8 where K was applied at 60 kg and 80 kg/ha respectively in two splits. However no significant difference s observed between T7 and T8. Split applications of K perform better than single application in enhancing CI and CSI in groundnut crop.
- MSI also varied among the treatments. The highest MSI was found in T8 and the lowest in T1. It increased with increase in the level of K application but significant increase was registered when K applied in split at 60 kg/ha (T7) and 80 kg/ha (T8). However no significant difference was noticed between these two treatments. Split application of K found better than single application in restoring MSI.
- Leaf water potential (WP), MC, RWC and RWD of leaf considered as putative traits for drought tolerance were influenced by the level and timing of K application in groundnut crop. Increase in the level of K increased WP, MC and RWC but decreased RWD. Among the treatments the highest WP, MC and RWC and reducing RWD of leaves in groundnut crop. However no significant difference was noticed among T6, T7 and T8.

Conclusion

Here the researchers are able to mark the Biological effect of potash on Oilseed crops and made an innovation for Local farmers. In view of the positive and beneficial effect of K application on growth, yield and drought tolerance ability of groundnut crop it may be concluded that improvement in the productivity of groundnut crop under low soil moisture or residual soil moisture condition can be possible through

increased application of K up to 80-100 kg/ha in split at sowing and flowering.

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