Original Research Article

Effect of molybdenum and zinc on Growth and Yield Attributes of Zaid Groundnut (*Arachis hypogaea* L.)

ABSTRACT

~~The experiment~~The ~~was~~experiment was conducted in CRF department of agronomy during summer season of 2022 on groundnut crop. The aim was to study the effect of soil application of molybdenum and foliar application of zinc ~~and~~on growth and yield of groundnut. The treatments consisted of 3 levels of molybdenum (0.5, 1.5, 2.0 kg/ha) and zinc

Comment [AHK1]: In abstract give the full meaning of CRF

(0.25,0.50,0.75%foliarapplication).Theapplication of1.5kg/hamolybdenumwith zinc 0.5%

recordedMaximumplantheight(54.50cm),highestplantdryweight(54.14g),numbero.of

Comment [AHK2]: Describe the experimental design used and measured parameters

nodulesper plant(47.37),seed index(42.08g),numbero.of podsper plant(22.85),nonumber.of kernelsper pod(2.09),seedyield(2985kg/ha),harvestindex(43.19%)andrecorded highernetreturn(1,31,578.00₹/ha),grossreturn(1,94,045.00₹/ha)andbenefit:cost ratio(2.11).

Comment [AHK3]: Your recommendation?

***Keywords*:economics,growth,groundnut,molybdenum,yield,zinc,growth,yield,economics,groundnut**

Introduction:

Groundnut(*Arachishypogaea*L.) isa most importantoilseedcroparoundthe world.It is oilseedcropaswellasgrainlegume.Peanutcontainsabout20%carbohydrate, 25-30%protein, 50%oilcontent,and5%fiberandashwhich make groundnuta richsource ofnutrition.Itisa profitablecropcultivated by millionsofsmallfarmersthroughouttheglobe,becauseofits nutritionaland economicvalue(**Ramprasad2020).**

Comment [AHK4]: Careful peanut is different from groundnut

Indiahasbeenrankingamongtopthreeproducersofgroundnutintheworld.Gujarat,TamilNadua ndMadhyaPradeshbeingthemajorproducingstatesinthecountry.Indiaproducesgroundnutinanareaof 6.09million/haandproductionandproductivityof10.21Millionmillion tonnestonsand1676kg/ha(Dire ctorateofEconomicsandStatistics2022).

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Molybdenum hasapositiveeffectonyield,quality andnoduleformation inlegume crops. The functionsof molybdenum in leguminousplants include nitratereduction,nodulationand nitrogenfixation **(Togayand Dogan2008)**. Molybdenumis required for normal plant growth,

reductionsupplywithmolybdenumtothegrowthmediumdecreasedactivitiesofnitratereductase andglutaminesynthetaseinvolvedatinitialstepsofnitrateassimilation**(Hristozkova*etal*.,2006).** ~~Molybdenumis theconstituentof nitrate reductase andnitrogenaseenzymes.Itis involved in reductionofnitratesforproteinsynthesisin allplants**(HazraandSom,1999).**~~

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Comment [AHK5]: ALREADY SAID BEFORE AVOID REPETITION

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Zincplaysasactivatorofseveralenzymesinplantsandisdirectly involvedinthe biosynthesisofgrowthsubstancessuchasauxin whichproducesmoreplantcellsandmoredry matter. Some investigatorsreported thatfoliar sprayingwithzinc couldcorrectzinc deficiency, improvegrowth,yieldandseedquality ofgroundnut(**Habbasha.,2014)**.Zincknowntobethe constituentof enzyme andalso involved insynthesisof pyruvic decarboxylase and indole acetic acid.Zinc isrequired invarious metabolic processesascatalysts.italso increases the contentof protein,calorificvalue,aminoacidand fat inoilseedcrop.Zinccatalysestheprocessofoxidation in plantcells and is vitalfor transformation ofcarbohydrates, regulates theconsumption of sugar, increasessourceofenergy fortheproductionofchlorophyll,aidsintheformationofauxinand promotesabsorptionofwater**(RadhikaandMeena2021)**.

Therefore,choiceofavariety withsuitabledoseofzincisnecessarytoenhancethe productivityofgroundnut.Hence,anexperimentwasplannedtostudytheinfluenceoflevelsMo and Znongrowthandyieldofsummergroundnut.

MaterialandMethods:

A fieldexperiment wasconducted during *zaid*season of2021-22at the Crop ResearchFarm, DepartmentofAgronomy,NainiAgriculturalInstitute,SamHigginbottomUniversity of agricultureTechnology andSciences,Prayagraj(U.P.)India.Thesoilofexperimentalplotwas sandy loamy intexture,nearly neutralinsoilreaction(pH7.8),lowinorganiccarbon(0.35%), Thetreatmentsconsistof0.5kg/hamolybdenum+0.25%zincfoliar,0.5kg/hamolybdenum+ 0.50% zinc foliar,0.5kg/ha molybdenum+ 0.75%zinc foliar,1.5kg/hamolybdenum+ 0.25% zinc foliar,1.5kg/ha molybdenum+ 0.50% zinc foliar,1.5kg/hamolybdenum+0.75% zinc foliar,2.0 kg/ha molybdenum+ 0.25% zinc foliar,2.0 kg/ha molybdenum+ 0.50% zinc foliar,2.0kg/ha molybdenum+ 0.75%zinc foliar,andcontrolplot.The experimentwas laidoutin Randomized BlockDesign,with10treatmentsreplicatedthrice.Theobservationswererecordedforplant

height,plantdry weight,Cropgrowthrate(g/m2/day),Relativegrowthrate,Numberofnodules, Number ofpods/plant,Kernels/pod,seed index,seedyield,Haulmyield,Harvest index.The collecteddatawassubjectedtostatisticalanalysisby analysisofvariancemethod**(Gomezand Gomez,1976).**

ResultandDiscussion

Preharvest

Plantheight-At100 days after sowing (DAS),sSignificantlyhigherplantheight(54.14cm)wasrecordedin treatment-6(1.5kg/ha molybdenum+0.75%zinc foliar).However,treatment-9(2.0kg/ha molybdenum+0.75%zinc foliar)) thesignificantlyhigherplantheightmightbeduetowiththe applicationofmolybdenumlevelsand zinc. Theimprovementinthesegrowthcharactersmightbeduetothefactthatmolybdenumisaconstituentofenzymenitrogenase,whichisessentialfortheprocessofsymbioticN2fixation.Thesefindingsareinclosecon formitywiththeresultsobtainedby**Singh*etal.*(2014)&Movalia*etal.*(2018)**.Theincreaseinplantheight maybeattributedtoroleofzincasacatalystorstimulantinmostofphysiologicalandmetabolicprocessand italsoimportantinsynthesisoftrytophane,acomponentofsomeproteinandacompoundneededforprodu ctionofgrowthhormones(auxins)likeindoleaceticacid.Similarresultswerealsoreportedby**Halepyati(2001)**

Plantdryweight-At100DASSignificantlyhigherplantdryweight(54.14g/plant)was recorded in treatment-6(1.5kg/hamolybdenum +0.75%zinc foliar).However,treatment-7 (2.0kg/hamolybdenum+0.25%zincfoliar))thesignificantly higherplantdryweightmight beduetowiththeapplicationofmolybdenumlevelsandzinc. Theimprovementinthese growthcharactersmight beduetothefactthatmolybdenumisaconstituentofenzyme nitrogenase,whichisessentialfortheprocessofsymbioticN_2 fixation.Thesefindingsarein closeconformitywiththeresultsobtainedby**Singh*etal.*(2014).**Theincreaseindryweight maybeattributedto roleofzincasacatalystorstimulantinmostofphysiologicaland metabolicprocessanditalsoimportantinsynthesisoftrytophane,acomponentofsome proteinandacompoundneededforproductionofgrowthhormones (auxins) like indole acetic acid.Similarresultswerealsoreportedby**Halepyati(2001).**

Comment [AHK6]: IN RESULT I SAW ECONOMIC PARAMETERS CALCULATED BUT NOT STATED IN METHODOLOGY. I SUGGEST YOU TO GIVE A DESCRIPTION OF DIFFERENT ECONOMIC PARAMETERS CALCULATED

Comment [AHK7]: THERE IS NO STATISTICAL ANALYSIS? IF YES, PRESENT HERE. I OBSERVED YOU CARRIED OUT A f TEST METHOD I THINK SINCE YOUR AIM IS TO COMPARE EFFECT AND CHOOSE THE BEST ONE IT IS GOOD TO DO THE ANOVA ALSO

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Comment [AHK8]: THERE IS A CONFUSION HERE.TELLEXACTTELEY WHICH ONE GAVE THE HIGHEST RESULT. IF YOU HAVE DONE THE ANOVA YOU CAN EASILY CHOOSE THE BEST OR MAY BE THEY ARE THE SAME

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Comment [AHK9]: SAME OBSERVATION AS THE UPPER

Comment [AHK10]: YOU ARE REPEATING THE SAME THING AS ON PLANT HEIGHT

Numberof Nodules

At100DASsignificantlyhighernumberofnodules/plants(47.37)wasrecordedintreatment-6(1.5kg/hamolybdenum+0.75%zincfoliar).However,treatment-5(1.5kg/hamolybdenum +0.50%zincfoliar)thesignificantlyhighernumberofnodulesmight beduetowiththe applicationofmolybdenumlevelsandzinc.~~molybdenum~~Molybdenumsuppliedinoptimumquantity seems tohavefavouredplantvegetativegrowth,thesefindingsarecloseconformity withresults obtainedby**Movalia*etal*.(2018)**.Zincmighthavestimulated theactivitiesof microorganisms thatmadetheplantnutrientsreadilyavailabletothecropswhichaugmentedhighernodule growthresultedinhigherphotosynthesisandconsequently thehighergrowthratemighthave resultedin favorableeffect ongrowthattributes*viz.*,drymatteraccumulationandroot nodulation,thesefindingsarecloseconformitywithresultsobtainedby**Halepyati(2001)**

Comment [AHK11]: WHICH????? ARE YOU SURE IT IS THE OPTIMUM???

Postharvest

Numberofpods/plant

Significantlyhighernumberofpods/plant(22.85)however,2kg/hamolybdenum +0.75%zincwerefoundtobestatistically onparwith1.5kgmolybdenum+0.75%zincThe improvementinphotosynthesisandcarbohydratemetabolismresultingintogreaterformation ofphotosyntheticandmetabolitesinsourceandlaterontranslocatedinthe newlyformedsinks whichultimatelyincreasednumberofpods/plantTheseresultsareinagreementwiththefindings of**Movalia*etal*.(2018)&Singh*etal*.(2014)**.

Kernels/pod

Significantly higherkernels/pod(2.09))however,2kg/hamolybdenum+0.75%zinc werefoundtobestatisticallyonparwith1.5kgmolybdenum+0.75%zincThebeneficialeffect oforganicmanuring mightbeduetoimprovementinthephysicalconditionofsoilaswellas increasedavailabilityofplantnutrients,whichresultsincreasingkernels/pod .Theavailabilityandoptimumregularsupplyofplantnutrientsmighthavefavorablyinfluenced

theflowerингandkernelformationwhichultimatelyincreasedpods/plant.Thoseresultsarein conformitywiththoseof**Movalia*etal*.(2018).**

Seedindex(g)

Thestatisticalanalysisonseedindexwasfoundtobesignificanthighestseedindex(42.08g) wasrecordedwithtreatment1.5kgmolybdenum+0.75%zinc.however,2kgmolybdenum +0.75%zincwerefoundtobestatisticallyonparwith1.5kgmolybdenum+0.75%zincSeed indexwasinfluencedbytheapplicationofmolybdenumandzincwhichmightbedueto charactershighlyinfluencedbyitsgeneticmakeup.

Comment [AHK12]: HOW DID YOU GET THIS RESULT???

Comment [AHK13]: THERE IS NO DISCUSSION HERE

Seedyield(t/ha)

Theseedyieldshowedincreasing trendwiththeapplicationofmolybdenumand zinc in groundnut.Thehighestseedyieldwasobtainedwiththetreatment1.5kgmolybdenum+0.75% zinc(2985kg/ha~~).Treatment~~). Treatmentwith2kgmolybdenum+0.75%zincwerefoundtobestatistically onparwith1.5kgmolybdenum+0.75%zinc.

YieldincreaseswithincreaseinMoapplicationmightbeduetoincreasedgrowthcharactersand yield attributesbecause of its unique role in enhancing N-fixation, therebyincreasing N availability toplantsforefficientgrowthanddevelopmentwhichmighthaveenhanced photosynthesisandsynthesisother metabolitesforplantuse.Similarfinding werereportedby **Halepyati(2001)&Movalia*etal*.(2018).**

Haulmyield (t/ha)

Thehaulmyield ofgroundnutwas also influencedbytheapplicationof molybdenumand zinc. Highesthaulmyield(3947kg/ha)wasrecordedhighestin2kg molybdenum+0.75% zinc. Treatmentwith 1.5kgmolybdenum+0.75% zincwas foundtobestatisticallyonparwith 2kgmolybdenum+0.75%zinc.

Applicationofpoultry manureandvermicomposttogroundnutwhichresulttoslowly releasing availablenutrientswerehadfavourableeffectongrowthandbiomassproduction similarresultswerereportedby**Chauhan*etal*.(2013)&Movalia*et al*.(2018)**

Comment [AHK14]: NOT RELATED TO YOUR RESULT FIND AN OTHER AUTHORS

Harvestindex(%)

The datashowedsignificantdifference in1.5kg molybdenum+ 0.75% zinc (43.19) harvestindex. however,treatmentwith2kgmolybdenum+0.75%zincwerefoundtobe statisticallyonparwith1.5kgmolybdenum+0.75% zinc.

GrossReturns(₹/ha)

Datapertainingtothegrossreturnsasinfluencedbyvarioustreatmentsarepresentedin Table3Grossreturns(1,94,045.00₹/ha)was foundtobehighestintreatmentwith application1.5kgmolybdenum+0.75% zincandtheminimumgross (1,48,222₹/ha)wasfoundtointreatmentwithapplicationof0.5kgmolybdenum+ 0.25%zincascomparedtoothertreatments.

NetReturns(₹/ha)

Datapertainingtothenet returnsasinfluencedbyvarioustreatmentsarepresentedin Table3.Net returns(1,31,578.00₹/ha)wasfoundtobehighestintreatmentwith applicationof1.5kgmolybdenum+0.75% zinc andtheminimumgross (88,014.00₹/ha)wasfoundtobeintreatmentwithapplicationof0.5kgmolybdenum+ 0.25%zincascomparedtoothertreatments

BenefitCostRatio(₹/ha)

Datapertainingtothe B:Cratioasinfluencedbyvarioustreatmentsarepresentedin Table3.Benefitcostratio(2.11)wasfoundtobehighestintreatmentwithapplicationof 1.5kgmolybdenum+0.75%zincandtheminimumBenefitcostratio(1.46)wasfoundto beintreatmentwith applicationof0.5kgmolybdenum+0.25%zincascomparedto othertreatments.

CONCLUSION

Itwasconcludedthatwiththeapplicationofmolybdenum1.5kg/haalongwiththeZinc 0.75%foliarapplication(Treatment-6),recordedhigheryieldattributes&yieldandalso maximumbenefitcostratio

Comment [AHK15]: WITH A CLOSE REGARD ON YOUR RESULT, WE CAN NOTICED THAT THERE IS NO BIG DIFFERENCE BETWEEN YOUR PRETENDING BEST TREATMENT AND YOUR CONTROL PLOT

Comment [AHK16]: NOT SUFFICIENT WHERE ARE RECOMMANDATION AND PERSPECTIVES

REFERENCES

1. Gomez,K.A.,Gomez,A.A.,(1976)Threeormorefactorexperiment.(In:) *Statistical ProcedureforAgriculturalResearch2nded.*139-141.

2. Gracy,C.P.,JyotiNaik.andNagashree,N.,2013.GroundnutPricesToHover Around MSP. Dep. Agric. Mktg. co-operation and business Management, University ofAgriculturalSciences,GKVK,Bengaluru-65.

3.ElHabbasha,El Sayed.(2014).Impactof NitrogenFertilizer andZinc Foliar ApplicationonGrowth,Yield,YieldAttributesand Some Chemical Constituentsof Groundnut.InternationalJournalofPlant&SoilScience.InternationaljournalofPlant &SoilScience.4(3):259-264.

4. Togay, Y.and Dogan, Y., 2008, Research on the effect of phosphorus and molybdenumapplications on theyield andyieldparameters in lentil (Lens culinaris Medic.).AfricanJ.Biotech.,7(9):1256-1260.

5. Hristozkova,M.,Geneva,M.andStancheva,I.2006,ResponseofPeaPlants(Pisum sativumL.)toReducedSupply withMolybdenumandCopper.,Int.J.Agricand Biol.,8(2):218-220.

6.Hazra,P.andSom,M.G.,1999.Technology forvegetableproductionsand improvement.,Nayapakash,206BidhanSaraniCalcutta.

7. RamprasadNandi,HasimReja,NitinChatterjee,AnimeshGhoshBagandGora ChandHazra(2020).EffectofZnandB onthegrowthandnutrientuptake in Groundnut.*CurrentJournalof AppliedScienceandTechnology*39(1):1-10.

8. KRadhikaandSMeena2021.Effectofzincongrowth,yield,nutrientuptakeand qualityofgroundnut:Areview.*ThePharmaInnovationJournal.* 10(2):541-546.

9. Halepyati,A.S.2001.Effectofmoistureregimesandzinclevelsonthegrowthand yieldofsummergroundnut. *Karnataka JournalofAgriculturalScience,* 14(2):451-453

10. MovaliaJA,ParmarKB,VekariaLC.Effectofboronandmolybdenumonyield andyieldattributesof summer greengram(Vigna radiataL.) under mediumblack calcareoussoils.Inter.Jour.ofChem.Studies,2018.

11. Singh,S.,Singh,H.,Seema,Singh,K.andSharma,V.K.2014.Effectofintegrated useofrockphosphate,molybdenumandphosphatesolubilizing bacteriaonlentil (Lensculinaris) inanalluvialsoil.*IndianJournalof Agronomy*,59(3):433-438.

12.Chauhan,S.,A.,TitovandD.S.Tomar.2013.Effectofpotassium,sulphurandzincongrowth yieldandoilcontent insoybean(Glycine max(L.) Merill) invertisolsof centralIndia.*IndianJ.ofAppliedresearch*.3(6):489-491.

Table1.EffectofplantheightofGroundnutasinfluencedbyCalciumandBoron.

SNo	Treatments	100DAS		During60-80DAS		
		plantheight(cm)	Numberof nodules/plant	Plantdry weight (g/plant)	CropGrowth Rate(g/m^2/day)	Relativegrowthrate (g/g/day)
1.	0.5kg/hamolybdenum+0.25%zincfoliar	47.90	41.90	46.02	34.16	0.0221
2.	0.5kg/hamolybdenum+0.50%zincfoliar	48.10	42.10	47.95	37.24	0.0229
3.	0.5kg/hamolybdenum+ 0.75%zincfoliar	49.07	43.07	49.06	37.18	0.0224
4.	1.5kg/hamolybdenum+ 0.25%zincfoliar	49.40	43.40	48.69	35.57	0.0214
5.	1.5kg/hamolybdenum+ 0.50%zincfoliar	49.67	46.33	50.51	38.19	0.0215
6.	1.5kg/hamolybdenum+0.75% zincfoliar	54.50	47.37	54.14	45.49	0.0222
7.	2.0kg/hamolybdenum+ 0.25%zincfoliar	50.10	44.10	50.03	38.03	0.0218
8.	2.0kg/hamolybdenum+0.50%zincfoliar	51.00	45.00	49.30	36.36	0.0217
9.	2.0kg/hamolybdenum+0.75%zincfoliar	53.30	46.97	53.51	35.34	0.0212
10.	Control	53.20	46.20	54.13	43.15	0.0225
	F-test	S	s	S	NS	NS
	Sem±	0.26	0.20	0.66	2.80	0.0010
	CDat5%	0.79	0.600	1.96	_	

Comment [AHK17]: THESE 3 RESULTS ARE YOU SURE THEY ARE DIFFERENT???

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Table2.EffectofyieldandyieldattributesofGroundnutasinfluencedbyMolybdenumandZincfoliar.

SNo	Treatments	No.ofpods/ plant	No.of kernels/ pod (g)	Seedindex (g)	Seedyield (kg/ha)	Haulmyield (kg/ha)	Harvestindex (%)
1.	0.5kg/hamolybdenum+0.25%zinc foliar	17.36	1.53	35.39	2280	3434	39.87
2.	0.5kg/hamolybdenum+0.50%zinc foliar	18.24	1.56	35.63	2346	3507	40.08
3.	0.5kg/hamolybdenum+0.75%zinc foliar	18.65	1.60	36.02	2419	3518	40.74
4.	1.5kg/hamolybdenum+0.25%zinc foliar	19.12	1.65	36.22	2548	3583	41.55
5.	1.5kg/hamolybdenum+0.50%zinc foliar	19.57	1.67	37.07	2553	3591	41.55
6.	1.5kg/hamolybdenum+0.75%zinc foliar	22.85	2.09	42.08	2985	3927	43.19
7.	2.0kg/hamolybdenum+0.25%zinc foliar	20.54	1.71	38.24	2679	3698	42.01
8.	2.0kg/hamolybdenum+0.50%zinc foliar	20.95	1.78	39.35	2791	3770	42.54
9.	2.0kg/hamolybdenum+0.75%zinc foliar	22.50	2.00	41.65	2966	3947	42.91
10.	N:P:K- 20:40:60(control)	21.53	1.87	40.34	2769	3884	41.62
	F-test			S	SSSSNS		
	Sem±	0.23	0.03	0.19	42.29	25.76	0.45
	CDat5%	0.69	0.10	0.58	125.64	76.53	1.35

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Table3.Effectofmolybdenumandzinconeconomicsofproductionofgroundnut

Treatment No.	Treatmentcombinations	Costof cultivation(₹/ha)	Grossreturn(₹/ha)	Netreturn(₹/ha)	Benefit:Cost ratio
1.	0.5kg/hamolybdenum+0.25%zincfoliar	60,208.00	1,48,222.00	88,014.00	1.46
2.	0.5kg/hamolybdenum+0.50%zincfoliar	60,396.00	1,52,495.00	92,099.00	1.52
3.	0.5kg/hamolybdenum+0.75%zincfoliar	60,583.00	1,57214.00	96,631.00	1.60
4.	1.5kg/hamolybdenum+0.25%zincfoliar	62,092.00	1,65,616.00	1,03,524.00	1.67
5.	1.5kg/hamolybdenum+0.50%zincfoliar	62,280.00	1,65,976.00	1,03,696.00	1.66
6.	1.5kg/hamolybdenum+0.75%zincfoliar	62,467.00	1,94,045.00	1,31,578.00	2.11
7.	2.0kg/hamolybdenum+0.25%zincfoliar	63,054.00	1,74,139.00	1,11,085.00	1.76
8.	2.0kg/hamolybdenum+0.50%zincfoliar	63,242.00	1,81,438.00	1,18,196.00	1.87
9.	2.0kg/hamolybdenum+0.75%zincfoliar	63,429.00	1,92,781.00	1,29,352.00	2.04
10.	N:P:K-20:40:60(control)	58,021.00	179,990.00	1,21,969.00	2.10

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