

QI y dfr; bh foKku ij I vlks ds ruks dk çHko%, d Nksh I ehqk çnhI dëkj I gh*

QI y dfr; bh foKku foHkkx] vkpk; Zujæ no fo'ofok | ky; -f'k vks çks] kfxdh]
dëkjxat] v; k; k&224 229] mUkj çns k] HkkjrA

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of'od tyok; qifjorZ] c<rsrkieku ds: i eavks I vlksdsruks I fgr feeh dh ueh dh fLFkr eamrkj&p<ko] vxysij [kk | QI ykad QI y dsQft; ky, th dksde djusdk vuëku g\$ 50 o"ka I vlks ruko 'ol u dh nj eadeh ; k çdk'k I aySk.k dsLrj eadeh ds: i eakuk tkrk g\$; g Nksh I ehqk] geal vlks ruko vks çdk'k I aySk.k vks ikuh dsl æak eaisksdh of) ij bl dsçHko vks vuqnyu dsra= dscjseuohure tkudkj crkrk g\$ vuqnyu ds ra= dsdbZrjhdsgats i kksdksl vlksruks dh fLFkr dksl gu djusdh vuëfr nrk g\$; g feuh&fj0; wge I vlksdsruks dh I gu'khyrk ij foHkklu y[kkadsc; ku dksl kfr dj I drsgavks i ; kbj.kh; i fjlFkr; kaeeakewh cnyko I sl y p; kip; dsrst yphyi u dk dkj.k gsl drk g\$tsl I vlksdsruks I scpusdk igyk vks e[; dne g\$ 'kñ dëk: I vlks ruko] i kkskad of)] çdk'k I aySk.kA

Bhartiya Krishi Anushandhan Patrika, 35(4): 236-240

Effect of drought stress on crop physiology: A mini-review

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Received: October 2020

Accepted: November 2020

ABSTRACT

Global climate change, in the form of increasing temperature and fluctuating soil moisture conditions including drought stress, is projected to decrease the crop physiology of food crops over the next 50 years. Drought stress is an effect of considered as the lowering in the rate of respiration or decrease in the level of photosynthesis. This mini-review tells us the latest information about the drought stress and its effect on the growth of the plant with relation to photosynthesis and water and the mechanism of adaptation. There are numerous ways of the mechanism of adaptation that allows the plant to tolerate the drought stress condition. This mini-review we can prove the statement of different authors on the tolerance of drought stress and the slight changes in the environmental conditions may lead to the fast flexibility of the cell metabolism is the first and main step in the avoidance of drought stress.

Key words: Drought stress, Plant growth, Photosynthesis.

çLrkouk

nq; k Hkj ea [kk | mRi knu dh vof/k I vlks I s çHkkfor g\$ I vlks , d foLrkfr vl kekl; I vlks vof/k g\$ ts, d {k= eagrk g\$ tsyxkrkj uhp&vks r o"kkZçklr djrk g\$ fo'o Lrj ij] -f'k ikuh dk I cl scMk mi Hkkæak g\$ I Hkh fudkl h dsyxHkx 70% vks fodkl 'khy ns kkaea 95% rd ¼ Q, vks 2007½ dsfy, y[kkaduA i kksi ; kbj.k dsdbZrukadsvkl ikl g\$ ftueal sl vlks egROIwZ g\$

nq; k Hkj ea 50% I sfotHku QI ykadsmRi knu eaupl ku dsfy, I vlks ruko egROIwZ dkj.k g\$ çs bZ] , V vy ½2000½ , d h fLFkr; kaee i kkska ds Årdkaea ikuh dh deh gkrh g\$ ikuh dh deh gksudh tkp djusdsfy, foHkklu Lrjka ij bdk&fQft; ky,ftdy vko'; drk vks I y p; kip; dsl æak eadbZv/; ; u fd, x, g\$]

f'kukstdh d\$, V vy ¼1997½ gj tho i ; kbj.k I stbMk g\$ bl dk çHko i ; kbj.kh; dkjd dh 'kfä vks

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QI y dfr; bh foKku foHkkx] vkpk; Zujæ no fo'ofok | ky; -f'k vks çks] kfxdh] dëkjxat] v; k; k&224 229] mUkj çns k] HkkjrA

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I e; vʃ dkd vʃ vkuʃi'kd vl kek; rk dschp ckrphr }kjk fujh{k.k fd; k tk l drk gʃ bu dbzdkjdkaeal s, d dkjd thou ç.kkyh gʃftl sLFkjr l hek Hkh dgk tkrk gʃ bu dkjdka dh l hek dksruko dks>yusdsfy, fufgr l a = {kerk }kjk Hkh fu/kkzjr fd; k tk l drk gʃruko dh rhork vʃ l e; vof/kj Hkhnyk , l dʃ , V vy 1/19981/1 , d ubz'tyok; q; k ubz'LFkfr dsvknh gkusdh l a = dh {kerk i; kʃj.k eai fforu dsdkj.k gkusokysl nesdksde djusdsfy, cQj xqkka dh mi LFkfr dsdkj.k gʃ

i; kʃj.kh; dkjd] oynkj , Q] , V vy 1/20071/2 eafHkurk dsdkj.k vius'kjhj foKku dksuc, j [kusds fy, i kʃs dh {kerk ds l kFk 0; klr l vʃdsçfr mPp çfrjks {kerk dk vFkz gʃ yʃv 1/19821/2 dsvuq kj] ruko fd l h Hkh çfrdh ij fLFkfr gʃtsi i kʃs dh of) ; k fodkl eai fforu ykrk gʃ ruko dksfoHku dkjdka }kjk yk; k tk l drk gʃ tʃod çf; kvads: i eukfer i kʃkadh 'kkjhjd çf; kvla vʃ dk; kRed xrfok/k 1/p; ki p; eacnyko1/2 eai fforuA ruko ruo e] eq; c<fr ekxkadsigysdh vLFkjr ds dkj.k fd; k tkrk gʃ bl sl kek; cukdj vʃ fQj bl ea l qkjd fd; k tkrk gʃ bl vo/kk.kk dk , d l a kʃku nku, 'kcnkatʃ sf; w & ruko vʃ fml & LV3] fypkysj , p-ds vʃ vl; 1/19961/2 ndj rʃkj fd; k x; k FkA ruko dks l f; ; k mʃkʃtr djds i kʃs dsfodkl dsfy, ; yki h; ruko , d l dkjRed ruko gʃ fml & LV3 çefk ruko gʃ tks {fr dk dkj.k curk gʃ vʃ i kʃs dsfodkl dsLrj ea deh dsifj.kke Lo: i gkrk gʃ

i kʃka dh xrfok/k; ka ij l vʃs dk çHko

&10 l s&15 vf/kd dh {kerk} 'kkjhjd ?kVuk, j tʃ si Ūkh of)] LVkekVy pkyu] çdk'k l a yʃkd nj] vʃ ukbVʃstu p; ki p; eadeh ghMkbz vʃ ekosj 1/20091/1 i kʃkaeal vʃs dsruko dh 'kkjhjd ?kVuk ds v; ; u e] fj i kʃz dh xbz fd i kʃkadh i kuh dh LFkfr] vDI j Årdkadh ty {kerk dks eki dj] i kuh dh l Hkfor {kerk dks de djds l y fodkl vʃ çk/hu l a yʃk.k dks de djrh gʃ dkcū Mkbv, DI kbM vʃ i Ūkh ok'i kʃ tʃu dk çokg de gsk tkrk gʃ yʃdu çkykbu vʃ , fcl fl d , fl M ruko dk l p; c<+ tkrk gʃ ghMkbz vʃ ekosj 1/20091/1 ruko] tM+vʃ 'kw fodkl çHkfor gkrk gʃvʃ de gsk l drk gʃ

i kʃka dk LrjA l vʃk ruko] Ql y dh i Ńokj dkQh gn rd fuEu fof/k; kadks de djrh gʃ1& ouLi fr }kjk vo'kʃ'kr çdk'k l a yʃkd l f; fofdj.k dh deh 2& fofdj.k dh n{krk dks de djrh gʃ3& Ql y l pdkad eadehA d,uZ MkBz eʃj] i kuh dh [ki r ea deh vk, xh l tMh] 1/20081/1

ikni of) ij l vʃs dk çHko

l vʃk cg&vk; keh ruko gʃ tks fofHku pj.kka ea i kʃka dh of) dks çHkfor djrk gʃ ; kj Mkuko 1 , V vy 1/20031/1 futyhdj.k dh çf; k i kuh ds l a kʃk tʃ jkl k; fud] vʃ i kʃs dh 'kkjhjd çf; kvla vʃ l y yj f>Yyh ea ifforu dh vʃ ys tkrh gʃ rçk tM] , V vyA 1/19961/1 l vʃk , d tFv çf; k gʃD; kʃd bl ea ruko dk l a gʃ 'kkfey gʃ tks i kʃka dks l a Bu dsfoHku Lrjka ij çHkfor djrk gʃ cye , A , V vyA 1/19961/1 'kʃd okroj.k eai kuh dh mPp {kerk vʃ dʃky mi ; kx egRo i wʃz y{k.k gʃ i kuh dh of) vʃ mi ; kx dh nj vyx&vyx ck; kʃkl vʃ : i kRed vʃ 'kkjhjd xqkka l çHkfor gkrh gʃ i kuh ds mi ; kx dh n{krk dh çfrf; kj tc 'kkjhjd ik=ka l s çHkfor gkrh gʃ i kuh ds mi ; kx vʃ i kʃs dh of) ij fuHk djrh gʃ fodkl dks<kusokyh vko/u çf; k i kuh dh mi yC/krk ij fuHk djrh gʃ

i kuh dh LFkfr dh deh dsdkj.k tMac<+tkrh gʃ gEcfyu ,] , V vyA 1/19911/1 , d i kʃs dh vuqny LFkfr ea of) dsrgr] i kʃkaea , d mPp i Ūkh {k= vuqkr dh vko' ; drk gkrh gʃD; kʃd , d mPp i Ūkh {k= vuqkr çdk'k l a yʃk.k dh nj dks<krk gʃ fodkl nj eafHkurk i Ūkh {k= vuqkr] i wʃ , pA] , V vyA 1/19901/2 eavvj ds dkj.k gʃ mPp i Ūkh {k= dh cMk [keh ; g gʃfd i kuh dh vki frz de gkus ij Hkh i kuh dsok'i kʃ tʃu dh nj vf/kd gkrh gʃ bl çdkj i Ūkh {k= vuqkr of) eæenn djrk gʃ yʃdu ; g mPp i kuh dsuq l ku l sHk tMk gʃk gʃ u dʃy ck; kʃkl vko/u }kjk çfYd i kuh ds vo'kʃk.k vʃ gku ds varj ds l kFk&l kFk i kʃs dsfoHku fgLI ka eadkcū vʃ fodkl eaHkh cgr ; kx nku gʃ

jkekl , e , y th] , V vyA 1/19991/2 eadgk x; k gʃfd l vʃs l sck; kʃkl dh rnyuk ea l vʃs i kʃka ds teko ea dkQh gn rd deh vkrh gʃ rktæ0; eku dh rnyuk ea l vʃs ck; kʃkl ij l vʃs dk viʃk—r de çHko i kʃs ds 'kjhj ea i kuh l sl a kʃ/kr xMeMk dh mi LFkfr ds ifj.kkeLo: i gkrk gʃ

i kʃka ds ty l a kʃka ea l vʃs ds ruko eacnyko

Hkktu ds mRi knu ea l vʃk l cl segRo i wʃz ck/kk gʃ l vʃs l s i kʃka dks jgr nʃk , d e] dy dke gʃ gkykʃd] vkl ekfVd l ek; kstu bl Vu] udkA , V vyA 1/19861/2 ea Qk; næn l kfr gsk l drk gʃ Ql y ds i kʃka e] i kuh dh deh l s cpus ds fy, dbz ræ ekst n Fkʃ ftl ea fV'kw vʃ l y fMgkBMʃ ku l scpuk] l gu djuk vʃ cpuk 'kkfey FkA c<fr i kuh dh deh dsrgr p; ki p; dks tkjh j [kusdsfy,

i ; klr l y cxj dksuc, j [kusl s i kksl i fkk l gu djrs gA ruko dscfr l fg". kpk eade l sde nksræ 'kfev gkrs gA vki ekfVd l ek; kstu vlg Årdka ds ykpnkj xqkkaea ifjorū ehl vlgA 1988A dbZ Ql y i kkskaea l fkk cfrjkk dk dk; kRed ?kVd v, LekfVd l ek; kstu yMyks , e, e] 1990½ gA dbZçtkfr; kaea l y Vxj dksuc, j [kus ds fy, v, LekfVd , MtLvev , d egRo i wkz ræ gA

; g i kksdh p; kip; xrfrof/k dksuc, j [krk gS vlg bl fy, i kks dh of) vlg mRikndrk dks c<krk gS 'kdsy dš , V vyA 1982½A vki ekfVd l ek; kstu ; kfxdka dk fuekZk djrk gSts Ård ds futyhdj .k dh vlg tkrk gS vlg i kkskaea dks' kdk ds vki ekfVd {kerk dks Hkh de djrk gA l fksdh fLFkr dsrgr i kkskaea : V vlg 'kw fodkl dksuc, j [kuseavki ekfVd l ek; kstu Hkh ; ksnku nrk gS cæ bZ A , V vyA 1997½A fofHku fj i kkskaea dgk x; k gSfd i kkskaea p; kip; dh çfØ; k i wkZ i kuh dh {kerk dscfr l onu'khy gStkkl , pthj , V vyA 1992½A , d l y ds Vxj nko vlg ek=k dschp l æk ykp eai fforū dk i fj .kke gš tks l fksdh fLFkr] ejh , V vyA 12000½ ds dkj .k l j te fkh Ql y eabl fj 'rs dks feyk] tçd tykVø] 12005½ d, eu chu Ø, i ea; g fj 'rk i k; kA

l fksdh fLFkr dsrgr] i ūk dsi kuh dh {kerk dk Mv/k bl dh dk; kRed xrfrof/k dksuc, j [kus ds fy, i kksdh dbZçtkfr; kaea , d mi ; ksch l ærd gS OgkbV Mh,] , V vyA 12000½A çkykbu p; kip; eafHkuurk fofHku Ql yka eai kbZ tkrh gš yfdu ; g Bhd l s Kkr ughagSfd i kkskaea l fksl sç—fr ds fy, l onu 'khyrk ; k l fg". kpk eabfeuks , fl M egRo i wkZ Hkiedk fuHkkrk gS gA u bA , V vyA 1980½A usj h & btks , V vyA 1990½ eadgk x; k gSfd fdl h fn, x, ty dh fLFkr i kkskaea dh fofHku çtkfr; ka dsi kksdh p; kip; xrfrof/k eavarj fn [krh gA l a æ ea l fksdh pkv ds fy, l d j ds : i ea Vxj vlg ç, ykbu l p; dschp dk l æk bfj xks u , V vyA 1992½ } kj k fn; k x; k gA

çdk'k l åysk.k ij l fks dk çHko

i kkskaea l fks vlg i kuh dh deh ds dkj .k dkcZu vlg ukbV kstu vkræ kr eai fforū çdk'k l åysk.k dscxfr'khy fuyæu l stl/k gpk gSts DçA c, V 1991½A LVkæ/vk vlg u, u&LVkæ/vy l hek, j çdk'k l åyskd nj ea deh vkbZ okbt vlg vlg] , V vyA 1992½A l fkk l fg". kpk dk çedk egRo i kuh dsruko dsrgr çdk'k l åyskd e'khujh dh dk; Z {kerk dksuc, j [kuk gA i kuh dh deh dksnj djus ds fy, l a æ rsth l si kuh dh deh dksnj djus ds fy,

jalk dks cæ dj nrk gSok' i kkl tZu dsek/; e l š , u-vkj-cslj] , V vyA 1994½A i kkskaea çdk'k l åysk.k dh de nj vkræjd dkcZu Mkbov, DI kbM dh l ærk eadeh dsdkj .k gkrh gš ftl dsifj .kkeLo: i jkbcy/l & 1] 5&fcLQk Qv : fcl kš d, fuZd thj , V vyA 1992½ ds LFkku ij çdk'k l åysk.k dh l hek gkrh gA

l fkska Qk/vk l Lve II dh voekuuk ej i kuh dh deh dh fLFkr dsrgr byDV, u i fjogu dks jkd k tkrk gA dñ ekeykaej ; g i k; k tkrk gSfd Qk/vk l Lve II ea l fksdh fLFkr dsdkj .k v, DI htufodfl r djus okyk d, ElyDI {kfrxLr gStkrk gS vlg Qk/vk l Lve fj, D'ku l vj Mh 1 çkshu l stl+tkrk gA l fksdh fLFkr dsnkš ku] xš kads vknku & çnku dh {kerk ?kV tkrh gš ftl l sdkcZu Mkbov, DI kbM {kfr i frZ fcaq ea of) gkrh gš ftl ds ifj .kkeLo: i dkcZu Mkbov, DI kbM dh çdk'k l åysk.k dh voLFkk ea ifjorū gkrk gA l keL; i kkskaea ds l kfk l fks&rukoxLr i kksdh ryuk djrs l e; bu ?kVrk ly/kæ dh <yku eadeh nçkh tkrh gA

o, u l hej vlg Qkdšj 1981½ eadgk x; k gSfd : fcl ks dh vf/kdre dckkDI yšku n {krk dks dkcZu Mkbov, DI kbM oØ ds igys <yku ds : i ea ifjHkkr fd; k x; k gA tçd RuBP dks i p: mRi lu djus ds fy, i fuk; ka dh {kerk} fl b ij çdk'k l åysk.k dh nj l s ifjyf {kr gkrh gS vlg bl dk byDV, u i fjogu xrfrof/k ds l kfk l æk FkA : fcl ks dckkDI yšku xrfrof/k eadeh vlg vlg ; wchi h i p tZu {kerk l fksdh vlg tkrk gSts çkjHkd <yku] rst kj k MCY; j , V vyA 1999½ dsde gkus dk l ær nrk gA jalk vlg xš & jalk dkj dka ds dkj .k i kksdh çdk'k l åyskd nj ?kV tkrh gA ruko dsnkš ku] l fkk l fg". kpk çtkfr ml QD'ku dks fu; æ=r djrh gš ftl ds ifj .kkeLo: i dkcZu fu/kkZ .k gkrk gS vlg i kks dh ty n {krk ea l fkk gkrk gš y; j Mh MCY; w 12002½A 1987 ea ckdj vlg g, VZu usnsrjhdædk l æko fn; k] ftl gkusi kksdh of) ds fy, vuq; æ i fj fLFkr; kaea çfrnhfr dsi fforū dksfn [kk; ka igyh fof/k vlg s dh fLFkr eaj [kh i fuk; ka l s çfrnhfr ds Lrj eal; ware of) n'kZr h gA

lykLVkDouku LohdrkZ ds mfpr v, DI hdj .k ds dkj .k , d k gkrk gA tçd] nñ jh fof/k çfrnhfr Lrj ea 'keu fHkuurk ds fy, ftEenkj gS; k i fuk; ka l sçfrnhfr ds Lrj eavf/kdre of) ds : i ealHk tkuk tkrk gš ftl svlg s fLFkr eaj [kk tkrk gA çfrfØ; k dæ ij 'keu , d egku çHko dksn'kZrk gA çfrnhfr Lrj eadeh Qk/vk l Lve—II] , vlg vks bZ e] , V vyA 1993½ ds vki i kl ; k Hkhrj

ty&foHktu ,atbbe xfrfof/k ea deh l s l æf/kr gñ
çfrñtñlr Lrj ds 'keu ds ifj .kke Lo: i] xş&fofdj .k
ÅtkZeaof)] fxyekj vñ çtelj eñ ¼1995½ }kjk n[kh
tk, xñA byDV, u dh Dok/e mi t ds ifjogu eafujrj
deh ds dkj .k QkV/kbflgfc'ku gkrk gñ

I vñkk gñk i kñkk çdk'k l ãyşkd ekxZ }kjk l pñfyr
ÅtkZdsvuñkr eavf/kd deh dk l ãr nrk gñ okl l h
vñş euykñ ¼1999½ usbyDV, u dh Dok/e mi t ds ifjogu
eamYy[kuh; deh fn[kkusdsfy, , d ç; kx fd; k vñş
QkV/kñfedy 'keu dk mi pkj i kñkkae dñfe; e dsmi pkj
}kjk fd; k tk l drk gñvñş i kñkkae u, uQkV/kñkbu 'keu
}kjk Hkh fd; k tk l drk gñ

fu"d"ñ

bl Nkñh l hñl eh[kk dsek/; e l ş ge ; g fu"d"ñ
fudky l drsgşfd l vñskd dkj .k] jñk l hek dh of) gñ
jñk l hek dh cññ of) l a æ ds l Hkh çdk'k l ãyşkd
i şkehVj ea deh dh vñş tkrk gñ jñk ds cñ gñus l s
vol knxLr dñkZ Mkbv, Dl kbM vñRel kr gkrk gñ l vñkk
l Hkh igñvñkae çdk'k l ãyşk .k nj dñşçñkfor djrk gñ
ftu i kñkka us, Q oh, , Q, e cuk, j [kk gñ vñş os de
çñkfor gñrs gñ xş&jkl k; fud jkl k; fud 'keu ea de
of) ds l kñk l vñksdsruko dñçr l fg".kñekuk tkrk gñ

I mññ

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