A comparative study among some methods for evaluating stability in Egyptian cotton

Mohamed Nashaat Mahdey

Th~s study was conducted dur~ng two experimental seasons of 1988 and 1989 years, in the Experimentall Stat~onof Groppi Farm, belonging to !~inistry of Agriculture whichlocated at Giza Governorate. 'I~he in-vitro Mtissue cultured"banana plantlets of both Williams and Grand-Nain cultivarswere the plant material used in this ~nvest~gation. Thiswork a~med to examine and evaluate banana plantlets oftheabove ment~oned cultivars in responsa to type of grow~ngmed~a "7 substrate m~xtures· and two levels of u.e. nutrientmixture ·Universal California nutrient mixture", both invest~gated factors were studied i.n comb~nat~on. However, twofactorial exper~ments were conducted, both ~ncluded the samefourteen treatments (combin"t~ons between 7 substratem~xtures x 2 levels ofthe pol:rfeed U.e. nutr~ent m~xture,s~nce adapted plantlets of Wil.l~ams and Grand Na~n bananaevs were devoted for the f~I'St and second experiments,respect~vely. Thus, the following comb~nat~ons were used tobe exam~ned w~th a hope for .ach~ev~ng the most su~tableone/ones of them by wh~ch the opt~mum growth w~th a balancednutr~tional status could be real~zed for both bananacult~vars.Treatments IIcambination.s".1- Sand. The polyfeed UniversalCalifornia nutrient2- Sand + peatmoss.3- Sand + clay.4- Sand + aquastares.5- Sand + peatmoss + clay,6- Sand + peatmoss + ""ermicu:~ite.7- Peatmoss + clay.1- Sand.2- Sand + peatmoss.3- Sand + clay.4- Sand + aquastores.5- Sand + peatmoss + clay.6- Sand + peatmoss + vermiculite.7- Peatmoss + clay.mixture "U.C. nut.mix."was applied at the rate"An, that recommendedby California Universit~l.The U.C. nutrient mixturewas added to theSUbstrate mixture atthe rate "B", i.e. at'/2 strength of thelevel "A".In each experiment "Williams/Grand Nain", the abovementioned treatments were arrI'anged in a complete randomizeddesign. Every treatment was re,plicated four times with threeadapted plants grown individu"lly in a polyethylene bag pereach replicate. MeanWhile, the in-vitro banana plantletswere adapted by remaining to grow under controlled condition"in an inCUbator" for 6, 7 weeks during the first and secondexperimantal season, respectiv'ely.The Obtained results could be sWllll1arizedas follows :V.l. Vegetative growth : V.l.l. ~eriodical growth measurements:Pseudostem height, pseudostem diameter, number of greendeveloped leaves and leaf dilllensions "length and width" wereperiodically measured thre;;a times, i. e. 3 months aftertransplanting in pots of the differential combinationsthereafter at 2 months inte,rval for the Ill. 2nd and 3rdmeasuring, respectively.V.I.l.a) Pseudostem height "lenath" :Data obtained revealed that pseudostem height wasgreatly influenced by the diJ:ferential combinations (interactionbetween 7 types of media x 2 levels of nutrientmixture). The longest pseudostem of Williams cv. was gainedwhen plantlets were grown edther in (sand + peatmoss +vermiculite) or (sand + peat:llloSS +claY)and providing with"B" or "A" rates of U.C. nutrient mixture. respectively. Asfor Grand-Nain (Sand + peatmoss + clay) as combined eitherwith "S" or "A" levels of U.C. nut. mix. were the Superiortreatments during the III alld 2n..g experimental seasons,respectively. The reverse wa,; true with sand and (sand +aquastores) When combined with the lower rate of thepolYfeed nut. mix.. where the shortest pseudostem wasinduced. MeanWhile the other Cc>mbinations were in between.Regarding the Specific effect of growing media it isqui te evident that the response was grea tly pronounced,where the (sand + peatmoss .•clay) sUbstrate mixture rankedfirst followed by the (sand + peatmoss + vermiculite) exceptin the second season with Williams where the later was thesuperior. Moreover, sand Or (sand + aquastores) came latestWhile

the other grOWing media fell in between. With regard to specific effect of level of U.C. nutrient mixture On pseUdostIOm height, however the higherrate was more effective, but the response was lesspronounced than that of type of media.V.1.. 1.b) Pseudostem diameteJ[:ConCerning the interaction effect ”type of planting media x level of U.C. mix.), data obtained revealedObViously that both combinations ”treatments” of (sand =peatmoss + clay) prOVided with the higher rate of U.C. mix.and (sand + peatmoss + vermiCUlite) supplied also with ”A”rate were the SUperior for bc)th CUltivars, however theformer one tended to be more effective with Grand-Nain cv.,especially during second season. On the other hand, sand or(sand + aquastores) combined With the U. C. mixtureespecially at the lower ”B” rate Were the inferior, Whileother COmbinations were in between. As for Specific effectof the planting media, data Obtaj,nedshowed that both (sand+ peatmoss + cia:.’)and (sand + P”atmoss + vermiCUlite) Werethe superior for both cultivars, however the former one wasmore effective and produced thicker pseudostem with Grand-Nain, especially in 2nd season. In regard to the specificeffect of U.C. mix., data obtained showed that pseudostemdiameter Was positively responded to the level applied,although the response was more pronounced with Grand-Naincv, V .1.1.c) Total number of h,aalthy leaves/plant : Data concerning interaction effect (planting media xlevel of U.C. mix.) on the nUIOberof persistent green leavesper plant showed that combination of (sand + peatmoss +clay) amended with U.C. mix. at higher ”A” rate was thesuperior, followed by (sand + peatmoss + vermiculite)combined either with ”A” or ”E,”rate of U.C. mix and (sand +peatmoss + clay) supplied with the lower rate of nutrientmixture, while the combinatic’nsbetween (sand) or (sand +aquastores) from one hand and U.C. mixture either at ”A” or”S” level from the other were the inferior for Grand-Naincv. during both seasons and Williams cv. especially insecond season.Regarding specific effee:t of planting media, it isquite clear that both (sand + peatmoss + clay) and (sand +peatmoss + vermiculite) were the superior growing media forGrand-Nain cv. during two aeaaons, but with Williams secondand first growing media wera the most s-u:itable during 1stand 2nd seasons, respectively. As for the specific effect ofU.C. level applied, it was quite evident that however thehigher level resulted in an increase in number of leaves perplant especially with Williams cv. but the differences wereinsignificant in most cases.V.I.I.d) Leaf dimensionsV.I.I.d-I. Leaf lengthData obtained showed that both combinations of (sand +peatmoss + clay) and (sand + peatmoss + vermiculite) eachprovided with the higher rate of U.C. nutrient mixtureresulted in the longest leal: blade for both cultivars.However both combinations were equally effective and showedthe same response which was more pronounced at the last t..o•measuring dates in the first season. While in the secondseason the second combinations tended to be more effectiveespecially with Grand-Nain cv.As for specific effect of planting media, it is clearthat both SUbstrate mixtures of (sand + peatmoss + clay) and(sand + peatmoss + vermiculite) Were the most suitablegrowing mediaplanting mediaand Grand-Nainrespectively.for both cultivars. However, the secondshowed a relative efficiency with Williamscvs. during first and second seasons,On the other hand, leaf blade length was positivelyresponded to level of U.C. mixture especially at the lasttwo measuring datesl since differences were significant withboth banana cultivars.V.l.l.d-2. Leaf blade width:Regarding interaction effect (planting media x levelof U.C. mix.) it was clear that no specific trend for agiven combinations could be cletectedfor all measuring datesduring both seasons with two banana cvs. But to some extentit could be safely concluded that combinations between both(sand + peatmoss + clay) and (sand + peatmoss + vermiculite)from one side and two levels of U.C. mix. from the otherbesides (sand + peatmoss) am.mded with ”An rate of U.C. mix.induced the widest leaf blad”. Meanwhile, these combinationswere alternatively differed from one measuring date toanother along the same seallon for both cultivars. On theather hand, the narrowest blade was that of sand or (sand +aquestores) especially as bath were combined with the lowerrate of U.C. nutrient mix.Referringto s~cific effect of plating media of taineddata revealed that both plenting media of.(sand + peatmoss + clay) and (sand + peatmass + vermiculite)during bath seasons as well as (sand + peatmoss) duringsecond seaSOn were the superior, but (sand + aquastores) wasconcern. Infollowed by planting media of sand, in thisaddition, le”f blade width was positivelythe inferiorresponded to the specific effect of level of U.C. mix.especially at the last t·.qa ntE:!asuring dates from cne side;whereas the response was more pronounced with Grand-Nainthan Williams cvs. from the other.V.1.2. Final ·destructive”

gro’iII’th measurementsAs both e:<periments were terminated (two weeks later)from carrying out the last periodical growth measurementduring two seasons I the following growth measurements weredone : V.1 .2.1. Linear measurement:s of underground organsV.1.2.1.a) Corm diameter:As regard to interaction effect. obtained data showedthat the thick.est corm was ai-ways produced by plants grownin pots filled with both combinations between (sand +peatmoss + clay) and (sand + peat:noss + vermiculite) fromone hand and the higher rate of ·the U.C. mixture from theother, however, the combination of the first mixture showeda rela ti ve tendency to be mc,re ef fective, regardless ofcultivar. The reverse was true when plants were grown inpolyethylene bags contained sa.nd cr (sand + aquastores) asboth were providing with U.C. lllix. at the lower rate.With regard to specific effect of planting media, itcould be noticed clearly that bcth substrate mixtures of(sand’” peatmoss + clay) and (~;;and + peatmcae: + vermicul.i.te)had resulted in producing thickest corm, but the former oneseemed to be more suitable. On the contrary sand and (sand +aquastores) both were the inferior in this respect.Meanwhile, corm diameter was positively reacted with thelevel of U. C. mixture during beth seasons for both bananacultivars.V.l.2.l.b} Number of roots per plant:Referring to interaction effect (planting media x levelof U.C. mix.), data obtained showed that however the trendof response was not acutely settled, but to some extent itcould be concluded that the combination between (sand +peatmoss + clay) and the higher rate of U.C. mixture inducedroot system with an extensive fibrous branching than other,treatments. Contrary to that the combination between (sand +aquastores) and U.C. mix. at the lower rate was theinferior, since it showed the most sparest roots. As forspecific effect of planting media it was worthy to benoticed that (sand + peatmoss + clay) was the most suitablefollowed by (sand + peatmoss + vermiculite),peatmoss) (sand + clay), (peatmoss + clay) and(sand(sandaquastores) or sand in a de ending order. In addition numberof roots per plant was responded positively to specificeffect of level U.C. polyfeed mixture, but the response wasless pronounced than that detected with type of plantingmedia.V.l.2.1.c) Root diameter ::With regard to root diameter in response to interactioneffect, it was so clear to not:ice that it reacted markedlyto the different treatments, since combinations between(sand + peatmoss + clay) and (sand + peatmoss + vermiculite)from one side and the U.C. poly feed mixture either at higheror lower rates from the other induced the thickest roots.The reverse was true with send and (sand + aquastores)receiving U.C. mix. at ”Ali/liS·’ r a t e a .. Concerning specificeffect of growing media and level of nutrient mixture dataobtained showed that the thickest roots were alwaysconcomi tant to both (sand + pe atmoss + clay) and (sand +peatmoss + vermiculite), beside the higher rate of U.C.mixture, however the response was more pronounced with thefirst factor than second.V.l.2.1.d) Root distributio~ :Generally, it could be noticed that the root verticalpenetration was extended to far longer distance than itshorizontal orientation as the root system distribution wasconcerned. However, the wide spreading root system wasalways conComitant to that plants grown under bothCombinations of (sand + peatmoss + clay) received ”A” levelof nutrient mixture and (sand + peatmoss + vermiCUlite)combined also with U.C. mix. at the higher rate with bothcultivars. Moreover, sand and (sand + aquastores) amendedwith U.C. either at higher or lo,,’er lev ••l were the inferior.Beside, other combinations WE!re in between,. however the.(sand + pea tmoss + clay) providing the lower rate of nutrientmixture was more effective. Such trend was true eithervertical or horizontal orientations were concerned.Referring to specific effect of growing media, it couldbe concluded that both substrate mixtures of (sand +peatmmoss + clay) and (sand + peatmoss + vermiculite) werethe most suitable, however fOI’mer one was more effectivethan later but differences are statistically negligible. Onthe other hand, inferior.sand or (sand + aquastores) were theAs for specific effect oj: level of U.C. mix. dataobtained revealed that the wider spreading roots eithervertically or horizontally was that of plants received thehigher level of such nutrient mixture, regardless of bananacultivar.V.1..2.2. Dry weight of differE,nt plant orqans V.1..2.2.1.. Aboveqround SyStE’. lpseudostem + leaves> :With regard to interaction effect, it could be safelyconcluded that both combinations between (sand + peatmoss +clay) or (sand + peatmoss + vermiculite) and the higherlevel of U.C. mixture were the most effective and sta tistically produced the heavi,ast aerial system for bothcui tivars. Moreover,. {sand + peatmosa} provi.di.ug wi.th ft A”rate of U.C. mix. and (sand + peatmoss + clay) or (sand +”l-c-;’l_t,m~ r :oss + vermiculite) both c;:lmbined with U.C. mix. at thelowet’ rate, all ranked second, but sand or (sand + of U.r:. mi~.

Wi=Orp. ,.hp inf~rinr. Rp.~ides. other cOmbinations fell in between the aforesaid two extremes.As for specific effect of planting media, it was cleared that both sUbstrate mixtures of (sand + peatmoss +clay) and (sand + peatmoss + '"e,rmicUlite) were the Superiormedia, followed by (sand + peat.1OSS) and (peatmoss + clay);but sand or (sand + aquastores) were the inferior.Nevertheless. specific effect of applied rate of theu. C. mixture was obviously detected. since heaviest shootsystem was statistically related to its higher level.V.l.2.2.2. Underground system (corm + roots! dry weight:V.1.2.2.2.a) Corm dry weight:Referring to interaction effect of planting media ascombined with the levels of the U.C. polyfeed mixture. itwas quite evident that both COmbinations of (sand + peatmoss+ clay) or (sand + peatmoss + "'ermiculite) each with thehigher "A" level of U. C. mix. we,re statistically the mostsui table ones and produced the 1:Leaviest corm. However. theabove mentioned both cOmbination~, were of equal effect withWilliams cv.. but the former was more effective t:hanlater with Grand-Nain ev. during two seasons. The reversewas true with both sand and (sand + aquastores) especiallyas combined with the lower rate! liB" of U.C. mix., howevercombination of sand was more dl~pressive. Moreover, othercombinations ranked in between.As for specific effect of planting media it was clearthat (sand + peatmoss + clay) was superior followed by(sand + peatxnossinferior planting+ vermiculite),medium. Besides,while sand was theother growing mdiawere intermediate.Regarding specific effect the level of U.C. mix.data obtained declared obv LouaLy that the higher ratestatistically increased corm dry weight of both cultivarsthan lower one with about 20-25 t.V.l .2.2.2. b) Root dry ••e.ight~ :Wi th regard to interaction e,ffect (typeof media + levelof U.C. mix.) it was quite evident that heaviest root dryweight was always concomitant to the (sand + peatmoss +clay) as combined with the higher level of U.C. nutrientmixture of both cul tivars. ThO! combinations of (sand +peatmoss + vermiculite) with "A" or nB" levels of thepolyfeed mixturepeatmos+ clay} receiving low,~r rate of U.C. mix. "B" aswell as (sand + clay) or (s,and + peatmoss) when eachamended with the higher rate of U.C. mix. all came next tothe superior treatment with l:i.ttle interruption. However,combinations between sand or (sand + aquastores) withboth levls of U. C. mixture we,re the inferior and induedthe lightest root dry weight.In regard to specific effect of planting media itcould be noticed clearly that (sand + peatmoss + clay)induced. The heaviest root dry weight, followed by (sand+ peatmoss + vermiculite) and (sand + clay) or (sand +peatmosS) thereafter (peatmoSf' + clay), (sand + aquastores)and latest sand which ranked final in a descendingorder. However, the specific effect of applied level ofU.C. mixture was markedly de,tected, since the higher ratewas more effective and steLtistically surpassed the lowerone for both cultivars, but the response was morepronounced with Williams cv.V.1. 2.2.3. Total plant d,ry weight :With regard to interact:ion effect of (planting media xlevel of U.C. nutrient mix.) on t he total plant dryweight, data obtained disclosed clearly that the heaviestplants in both banana cultivars were always concomitant tothe combination of (sand + peatmoss + clay) receiving U.C.mixture at the higher rate "An, followed by those of (sand +peatmoss + vermiculite} providing with "A" level of U.C.differences between both combinationswere insignificant during l~it and 2nd seasons for Grand-Nain and Wil.liams evs. respectively. Meanwhile, thereverse was true as both were compared with the othercombinations during both seasons regardless of bananacultivars. On the contrary, the lightest dry weight, wasclosely related to sand or (sand + aquastorees) especiallywhen combined with the lower "Blf rate of U.C. mixture. Othercombinations fell in between the above mentioned twoextremes with variable degrct3. of response from one seasoncultivar to another.In regard to specific effect of type of plantingmedia, it was quite evident that both (sand + peatmoss+clay) and (sand + peatmoss + vermiculite) were the mostsuitable substrate mixtures used as growing media, howeverthe formertrue withregardlesstended to be melreeffective. The reverse wassand alone followed by (sand + aquastores),of banana cultivar. Other media were intermediate.obviousBesides, the level of U. C. mixture showed aneffect, since the higher rate "A"the lower rate duringwas statisticallysurpassed two seasons ofstudy with both banana culti·~ars.V.2. Mineral constituents in various banana plants organV.2.1. Nitrogen content:Generally, it could be' observed that the differentplant organs (leaf, root and corm) of both banana cultivars,were obviously varied in their nitrogen content. YetI leafwas the richest organ followed by root and finally cormwhich ranked last, however the last two organs were notgreatly differed in most Cases.As for the interaction effect due to the combiningbetween planting media and level of the

U.C. nutrientmixture on the leaf, root and cram nitrogen content, it iseasy to be concluded that the combinations between (sand +peatmoss + clay) and/or (sand + peatmoss + vermiculite) fromone side and the higher level of U.C. nutrient mixture fromthe other were generally the superior and induced thehighest N't for all plant orga.ns. Beside, the combination of(peatmoss + clay) x higher level of the poly feed U.C.mixture resulted in incre,asing the rate of nitrogenaccumulation, especially in the under ground organs i. e. ,root and corm. Meanwhile, the reverse was true with thecombiantions of sand and (salld + aquastores) regardless oflevel of U.C. nutrient mixtu're added to each or the plantorgan for both cvs.Regarding specific eff,act of planting media, dataobtained revealed clearly that: the level of N for all plantorgans was significantly affected by the type of thesubstrate mix~ure. In spite of the substrate mixtures of(sand + peatmoss + clay), (sand + peatmoss + vermicUlite)and (peatmoss + clay) were generally the superior, but thedifferent plant organs were not tYPically responded to thesame medium/media. Since, (sand + peatmoss + clay) or(sand +peatmoss + vermiculite)were the Superior as leaf N wasconcerned but with roots (sand + peatmoss + clay) and (sand+ peatmoss + vermiculite) or (peatmoss + clay) e~ceeded theother planting media used in this respect.While for corm N the (peatmoss + clay) was thesuperior followed by (sand + pElatmoss + clay).As for the specific effect of the level U.C. nutrientmixture it is quite evident th;~t N content of the differentorgans was in close relationship to the rate of the polyfeed U.C. mixture applied, whe're the increase was significant,regardless of plant oX'gans for both cultivars ofbanana under study.V.2.2. Phosphorus content:Obtained data revealed tha·t level of phosphorus contentwas varied from one plant organ to another, since they couldbe arranged intci the following descending order roots, leafand corm whi ch showed the lo,"'estP, however di fferencebetween the fox'mer organs (rclot and leaf) was not muchpronounced. 19Concerni g the interaction effect of the differentcombinations (type of plaJ"ting media x level of U. c.nutrient mix(sand +it could be generally concluded thatplants of bo banana cultivars exhibited the maximum Pcontent as an of (sand + clay), (sand + peatmoss + clay) or5S + vermiculite) was combined with the higherlevel of U.C mixture, re9'ardless of plant organa. Theopposite was rue with such plants grown in pots of sand or(sand + aquas ores) received U.C. nutrient mixture either atthe lower or he higher rate.Neverthe eSSr leaf, r ce c and corm P was obviouslyinfluenced by the type planting medium, since (sand + clay),(sand + peatm ss + vermiculite) and (sand + peatmoss + clay)represented t e superior substrata mixture and resulted in asignificant i crease over other planting media, however th.eformer two mi tures were more effective in this respect.Beside, obtained data reflected also the specificeffect of the supplied level of the polyfeed U.C. mixture,where the hig er rate of the nutrient mixture significantlyincreased t e phosphorus level in most plant organs,regardless of banana cultivar.V.2.3. Potassium contentGenerally it could be observed that root potassiumpercentage showed a relative tendency to be higher in mostcases than leaves of the same cultivar, while the lowest K%was always CCIlcometent with t:he corm.A.s for potassium c e n ne n t; in three plant organsinvestigated of both banana cultivars as influenced by thedifferent combinations (interaction effect of planting mediaX level of U.C. mi~ture) obtained data showed that thecombinations between the planting media of (sand + clay),(sand + peatmoss + clay) or (peatmoss + clay) from one handand the higher level of U.C. nutrient mixture, from theother resulted significantly in most cases in an increase ofthe K% of the different plant organs. However, such trendwas interrupted in few caSies especially with corm. Thereverse was true with the combiantions of sand or (sand +aquastonres) either with tnl!higher or lower rate of U.C .nutrient mixture, although the later was more depressive.Regarding specific effe,ctof planting media, obtaineddata revealed that (sand + peatmoss + clay) andlor (sand +clay) and (peatmoss + clalr) planting media induced thehighest level of Itcontent illdifferent plant organs of bothbanana eva . On the contrary l!andor (sand + aquastores) werethe inferior in this concern.Referring to the specific effect of the poly feed U.C.mizture. it was clearly noticed that the application at thehigher rate of the nutrient mixture resulted significantlyin ic.creas.ing K% in three p1ant organs. Such increase wasmore pronounced in both leaves and roots than corm,regardless of banana cultivars during two seasons of study.V.3. Concluding remarks:1- Briefly. from the aforemelltioned data it could be safelyconcluded that both above and underground systems andtheir mineral composition in the tissue-cultured bananaplantlets of both Williams and Grand-Nain cultivars wereobviously influenced

by the different planting media ascombined with two levels c)£ the U.C. nutrient mixture.2- HoweverI such response tel some extent was variable fromone organ cultivar or season to another, but generaltrend could be easily detected for most cases. hence(sand + peatmoss + clay) and/or (sand + peatmoss +vermiculite) as amended with the higher level of U.C.nutrient mixture were the most favourable combinations bywhich the greatest values of the aforesaid growthmeasurements that associated with a balanced levels of N.P and K content were achieved.3- Proportions elf the different: components of the substratemixtures used for growing the tissue- cui tured, bananaplantlets, as well as others poly-feed nutrient mixturesat various rates and methods of their application throughdifferent st.ages of plantlets development should bere .v a Lu a e e d t:o acbieve better response which certainelywill be reJ,lected positively on banana growers, especially those working in the field of producingnursery plants. 50 further studies are needed in this respect.