Studies on competition and intercropping in maize and soybean

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Three field experiments were carried out at theAgricultural Research and Experiment Center of theFaculty of Agri’culture at Moshtohor, Zagaz19· Universityduring 1981 andl982 seasons. The experiments aimed atstudying. the effect of inter- and intra-specific competitionon gro-1thand yield of maize and soybean. The competitiverelationships as well as yield advantage gained fromint erc roppin g we re also conside red.The, soil in which the experiments were undertakenwas clay with a pH value of 7.8 and an organic mattercontent of 1.5%.The first experiment:Ef fect’o f int-ercrap pin!;’maize and soybean, on the growthand yield of intercrop components:The experiment airred to study the effect of intercroppingmaize and soybean grown under 9 different intercroppingsystems on the growth and yield of the intercropr: ”components., The- experi.ment included eleven treatmentswhich we re :1. 10000 maize plants + 30000 soybean plants/fad.(50% : 50% of pure stand density).2. 10000 maize’ plants + 45000 soybean” plants/fad.(50% : 75%. of pure stand density).3. 10000 maize plants + 60000 soybean plants/fad.(79% : 100% of pure stands density).4. 15000 maize plants + 30000 soybean plants/fad.(75% : 50% of pure stands density) •5. 15000 maize plants + 45000 soybean plants/fad.(79% : 75% of pure stands density)- 173 .,6. 15000 maize plants + 60000 soybean plants/fad.(75%,+ 100% of pure stands den si tv) •7. 20000 maize plants + 30000 soybean plants/fad.(100% .. 50% of pure st ands density)8. 20000 maize plants + 45000 soybean plants/fad.’(10~ : 75% of pure stands density).9. 20000 maize plants + 60000 soybean’ plants/fad.(10~ : 100% of pure stands density).10. 20000· maize; plants/fad;., in pure, stand.11. 60000 soybean plants/fad. in pure stands.Intercropping was followed in alternate rows (2:2)at all combinations io The expe rd.men t was laid. out in acompletely randomized block design with 5 replications.The plot area was 21 m2• Maize cultivar was Pioneer 514,a double cross, and soybean cultivar was Calland, amedium maturity cultivar(Group. III) •Soybean was planted on 23rd and 22nd May in 1981and 1982 seasons, respectively.Maize was planted on ~une 14 in both seasons (about21 days after soybean planting). The normal culturalpract ices· fa r both crops .,.,ere followed •.Data on growth. characters, yield of- components andseed and stra~ yield for int.rcrop components wererecorded.ResuIt s co uld be summarized as follows:A. Maize:1. Intercropping maize and soybean at different densities reducedslightly dry weight of maize plant organs. Increasingthe number of maize plants per unit area decreasedthe dry weight proportionally to maize density.Significant· difference wer~ rarely found 1n dryweight/plant.2 •. Growth characters of naize showed slight response tointercropping. Stem diameter and percentage ofbarren plants were si~}nificantly affected by intercropping.The Lnc r-ee se in maize population intercroppedwith soy.bean Ln cr-e ased the barren plantpercentage.3-. Yield components of mClizewere not significantlya ffected by in te rc rapping in spite 0 f some reduct ionswith increased intercr”opped maize population.4. The grain yield of maj.ze ”adjusted” par unit areaincreased significantLy by intercropping. The increaseranged from 3 to 43% in the first season and from 33 to55% in the second season over the grain yield of thepure stand. Best resLlt was obtained for the treatmentsincluding 75% : 50% and 100% : 50% maize and soybeanin the first and second season, respectively.5. The straw,yield of maize increased significantly as aresult o.f intercropping and followed about the similartrend of the grain yield.B. Soybean:6. Intercropping reduced the dry matter content of soybeanplant organs compared with solid planting. The greatestreduction was brought

about in the dry weight ofsoybean pods.7. Also growth characters and yield components of intercroppedsoybean we re reduced as a result of intercropping.The effect of intercropping on plarith.ight,seed weight/plant, number of pods/plant and 100-seedweight reached ~he level of significance.8. Intercropping signlficantly_r~d~ced the seed yield ofsoybean in both seasons. Relative seed yield ”adjusted”per unit area ranged between 40 and 97% in the firstseason and 61-100% in the second season, of the seedyield of sale cropping.9. The straw yield was not greatly affected by intercroppingas seed yield. Even, a great yield increase instraw yield was recorded in the second season as aresult of intercropping. Such result indicates thatstraw yield may follow an opposite trend of the seedyield.C. Competitive relationships and yield advantage:10. Land equivalent ratio for intercropping maize and soybeanshowed a yield advantage 1n 4. systems in the firs·tseason and in 8 systems (out of 9) in the second-season.Best result was obtained for the intercropping association75% maize + 100% 30ybean in the first season(LER = 1.089) and 75% !Ilaize+ 75% soybean in the secondseason (LER = 1.199).17611. Relative crowding coefficient of maize exceeded 1in all cases. but wal:;less than 1 for soybean. Theproduct of the coefficient obtained from intercropping(K) exceeded 1 1n some soystems in the first season andnearly in all systeml:iin the_second one. Maximum Kvalue was 1.49 in the first season and 2.52 in thesecond one.12. Aggressivity values showed that maize was the dominantcomponent in all casee whereas soybean was the dominatedcomponent.The Second Experiment:Effect of intercropping .some soybean cultivars on growthand yield of intercrop c:Emponents:The experiment included 18 treatments which were thecombination of 6 daf f er-ein t cropping systems and 3 levels ofpopulation densities.Cropping systems were:1. Calland cv. in sole planting. (included in maturityfroup III).2. Clark cv. in sole planting (included in maturity groupIII)•3. Columbuscv. in sole planting (included 1n maturitygroup III) •4. Calland intercropped with Clark.5. Calland intercropped with Columbus.6. Clark intercropped with Columbus.The three levels 0’= plant densities were:(1) low (60000 plants/fad.), (2) medium (90000 plants/fad.) and (3) high (120000 plants/fad.).The experiment was laid out in a split plot designwith 5 replications. The main plots included the croppingsystems and subplots contained the levels of plantdensities. The suh plot area was 16.8 m2• The normalcultural practicies of gr’;lwingsoybean were followed inboth seasons. Planting date wasl.23 and 22 May May inboth seasons.Data on ~rowth characters, yield components, seedand s~raw yield were recorde(.Resul ts could be sumna rLze d as follows:1. Intercropping showed some ~ffects on dry matter contentand growth characters IJf soybean cultivars where intercroppingreduced growth characters compared with solecropping. Columbus was more sensitive than Clark andCalland where intercropping showed significant effecton some growth characters.2. Weight of 100 seeds of Calland was significantlyaffected by intercropping where a reduction in this characterswere; recorded due to intercropping. Other yieldcomponents were not affected byintercropping.3. Intercropping significantly affected seed yield ofCalland (in one season) where a significant increasewas obtained. Wit h other cult ivars inte rcrappingalmost (insignificantli) increased seed yield.Calland with Clark produced 33% yield increase inthe first season and 12% increase in the second one.Calland with Columbus gave 11% yield increase in oneseason but a 5% yield reduction in the other one.Clark produc~d 6% more seed yield with Calland and5% more yield with C31umbus in the first season asagainst 8% increase and 6% reduction in the secondseason.Columbus gave 16 and 7% yield increase with Callandin the first and second season, respectively, but 1%and 13% yield reductions in combination with Clark inthe two successive seasons.4. Plant density showed significant effect on some growthcharacters of soybean cultivars particularly at laterstages of growth. Increasing the population densityreduced dry matter weight per plant and most of thegrowth character studied with significant differencesin some cas es •5. Yield components were also affected by populationdensity. Clark was more sensitive to density thanthe other two cultivars where significant reductionswere observed in number of pods and weight of pods/plant as well as in seed yield/plant.6. Increasing the population density increased the seedyield of the three cultivars with significantdifferences 1n some cases. On the average of t he th reecultivars, increasing the density from 60000 to90000 and 120000 plants/fad. increased seed yieldby 15 and 16% respectively in the first season,being 11 and 5% in the second one.7. Number of pods/plant and seed yield of Columbuscultivar (in 1982 season) as well as seed yieldin 1981 season) and straw yield of Calland (in 1982season) were significantly affected by

interactionbetween intercropping systems and plant density.8. Intercropping soybean cult ivars produced a yieldadvantage in both seasons. Best results were obtainedin LER values with intercropping Calland and Clark,followed by Calland/Columbus then Clark/Columbus. TheLER values were 1.195, 1.143 and 1.014 in the firstseason corresponding to 1.05~ 1.032 and 0.921,respectively in the second season.9. Intercropping soybean cultivars produced almost Kvalues exceeding 1 :Lndicating a yield advantage forintercropping. Higher values we re for Calland/Clarkcombinetion. Calland proved to be a good component inintercropping.10. Calland was a dom ananr component with Clark but adominated one with Columbus. Columbus was a dominantcomponent with Calland but a dominated with Clark.Clark was the dominant with Columbus but the dominatedwit h Calland.The Third Experiment:Effect of intercrQ.Qping some maize cult iva rs·on growt hand yield of intercrop components:The experiment included 18 treatments which were thecombination of 6 different cropping systems and 3 levelsof population densities.Cropping systems were:1. Pioneer 514 (a double cross) cultivar in sole planting.2. Giza 2 cultivar (a composite variety) in sole planting.3. Ciba (a single cross) cultivar in sale planting.4. Pioneer 514 intercropped with Giza 2.5. Pioneer 514 intercropped with Cd ba ,6. Giza 2 intercropped with Ciba.The three levels of plant densities were:(I) low (20000 plants/fad.). (2) medium (25000 plants/fad.) and (3) high (30000 plants/fad.).The experiment was laid out in a split plot deSignwith 5 replications. Tne main plots included the croppingsystems and the sub oLot s contained the levels ofplant densities. The subLplot area was 16.8 m2•The normal cultural practices of growing maizewere followed in both S4:laSons. Planting date was 14 .Junein bot h seasons.Data on growth cha rec re rs , yield components, grainand straw yield were recorded. The competitive relationshipsand yield adven t aq e of intercropping were estimated.Results could be summarized as follows:1. Intercropping showed significant effect on the dryweight of plant orqena only in some combinations. Ciba/Pioneer as well as Ciba/Giza 2 combinations reducedthe dry matter accumulation compared with solecropping of Ciba. Also -intercropping Giza 2 withPionee r dec rea sed the dry we ight 0 f leaves/plant ofPioneer compared with sale cropping, but Giza 2 mixedwith Ciba increased leaves dry weight/plant.2. Growth characters of maize were slightly affected byintercropping. Stem cliameter of Ciba cultivar atharvest, and number 01: ears/plant of Giza 2 weresignificantly affectecl by intercropping.’ Intercroppingalmost reduced these growth parameters.3. Ear characters, namely, ear length, ear diameter,number of grains/row, grain weight/ear, ear weightand IOO-grain weight c f the three tested cultivarswere significantly affected by intercropping almostin one season out of two. In all cases intercroppingreduced these characters compared with sale cropping.4. Intercropping affected the grain and straw yields ofmaize with different trend in both seasons. In mostcases. intercropping reduced grain yield per unitarea in the first season while almost increased itin the second season.S. Pioneer combined with Giba and Giza 2 producedrelatively 96 and 88% of the pure stand in the firstseason. corresponding to 111 and 102%. respectivelyin the second season. Giba combined with Pioneerand Giza 2 produced 91 and 88% of the pure stand inthe first season and 35 and 107% respectively inthe second season.Giza 2 in combination with Pioneer and Giba producedrelatively 99 and 98% of the pure stand yield in thefirst season corresponding to 114 and 107% in thesecond season.6. Plant density i bad .no ma rked effect on growth charactersand dry matter of maizE! cuLtLva rs ;The dry weight ofdifferent plant organs/plant were reduced withincreased population density. Such effect was rarelysignificant •7. Percentage of barren plants was increased withincreased population density particularly in Giza 2and Giba cultivars.8. Yield components in general and length and weight ofear in particular were negatively affected by plantdensity.9. The grain yield df the cultivars was affected bypopulation density. Giza 2 responded significantlyto plant density where a significant increase wasrecorded in both seasons.In the first season increasing the density from 20to 25 and 30 thousand plants/fad. increased the grainyield by 15 and 23% ’for Pioneer, 37 and 37% for Cibaand 15 and 23% for Giza 2.In the second season, Pioneer grain yield showedno response to population density, Giba grain-yieldrecorded a slight decrease with increased density,Giza 2 grain yield increased by 5 and 16% due toincrease in density.10. Number of ears/plant ofCiba (in 1982), ear diameterof Giza 2 (in 1982) and grain yield 0 f C iba cult ivar(in 1982) were significantly affected by the interactionbetween intercroppin~ system and plant density.11. Land eqUivalent ratio due to intercropping

showeddifferent results in both seasons.In 1981 intercropping of the 3 cultivars in all-combinations and under”the3 densities did not produceany yield advantage.Pioneer/Giba, Pioneer/Giza 2and Giba/Giza 2 produced LER values of 0.904, 0.957and 0.931 respectively. The medium density was thebest one in that season.In 1982, interc ropp ang increased the land usagemarkedly where the mixed cropping of Pioneer/Giba,Pioneer/Giza 2 and eiba/Giza 2 gave LER of 1.029,1.071 and 1.089, respectively.12. Relative crowding coefficient values were less than1 in the first season indicating a disadvantage forintercropping. In the second season, intercroppingproved promising whElre K values were 1.123 forPioneer/Giba, 1.344 for Pioneer/Giza 2 and 1.371 forGi.za 2/Giba. The mE:diumdensity was more effectivein t he second se asor- •13. Aggressivity values were positive for Pioneer (inPioneer/Giba), for Ciza (in Pioneer/Giza 2, and Giba/Giza 2) in both seaeons. Such result indicate agreat competitive abilities for Giza 2, fo1lo~ed byPioneer, then Giba.