Effect of some cultural practices on the performance of intercropping maize and potato

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Two year field trials were conducted at Zarzoora Experimental Station, El-Behaira during the 1996 and 1997 seasons. Potato (Solanum tuberosum) was relay cropped into maize (Zea Mays L.) plots on ridges running in the north- south and the east- west direction.Three way cross 310 maize was planted in 60-cm apart hills on one side of ridges on 2 June in 1996 and on 4 June in 1997 prior to the first irrigation. Plants were thinned to two plants per hill. Potato cvs. Diamont and spunta tubers were kept in the air 10 days to sprout before planting in the field. Tubers were planted on 16 August in 1996 and on 18 August in 1997 in wet soil in 25 cm apart hills and at 10 cm depth on the apposite side of the maize ridges, as well as on alternate ridges. When ridges run in the north- south direction, potato tubers were grown on the western side; and when they run in the east- west direction,potato tubers were grown on the northern side.Sole maize was seeded on 30- cm apart hills of 20 x103 plants/ fed; potato tubers, however, was planted in 25-cm hills of 24 x103 plants/ fed.Six different maize- potato intercropping pattens were also assessed in this experiment .1. Maize on the other side of all potato ridges (100% of fullmaize population density).2.Maize on the other side of every three potato ridges, whereas, the fourth was left free without growing maize (75% of full maize population density).3.Maize on the other side of every two potato ridges, whereas, the third was left free without growing maize (67% of full maize population density).4.Maize on the other side of one potato ridge, and alttemated with another potato ridge left without growing maize (50% of full maize population density).5.Maize on the other side of one potato ridge, and alttemated with two potato ridge left free from growing maize (33% of full maize population density).6.Maize on the other side of one potato ridge, and altternated with three potato ridges left without growing maize (25% of full maize population density).The experimental design consisted of a spilt- split plot arrangement in a randomized complete block design with four replication. Ridge direction was the main plot, intercropping patterns were the subplots, and the potato cultivars were the sub sub plots.I- EFFECT ON POTATO I- Effect on growth1- Data indicated that germination was tenaciously bounded with soil temperatures. There were consistent increases in time duration for potato to germinate with diminishing plant density of the shade crop up to lowest density (25% of full density).Differences between date of germinating potato grown alone and potato grown under the most dense planting of the shade crop was 4 days in North - South ridging and prolonged to reach 7 days in East - West ridging.2-When intercropping maize with potato under dense cropping of the shade crop, plant height of potato exceeded those under thin cropping of maize and was ever higher than potato grown in pure stand.3-The average number of branches of potato plants grown under thin planting of maize exceeded those of pure stand. But the converse in case of dense planting of maize. Gradual decreases in values of this trait were observed as the crop intensity increased up to the heaviest maize density (100%- full maize density) in the associations.4 The data indicated that there were gradual increases in fresh weight of plant and dry weight of shoot of potato plants under the shade crop with increasing plant population density of maize up to the heaviest density. The data also showed that the averages of fresh weight of total plants of thin shade treatments exceeded those of dense shade treatments, but both traits of pure stand potato were slightly lower than those grown under thin planting of maize.5- Potato plants grown solely had fresh weight of shoots rather less than those grown under thin population density of maize. Gradual increases in

fresh weight of shoot with increasing shade crop intensity within thin as well as the dense series of the shade treatments were also evident.6-Weight of fresh stems (tubers) behaved the converse. The data revealed that there were consistent reductions in fresh weight of tubers / plant with increasing plant population of the shade crop up to the heaviest (full maize population density- 100%). Fresh weight of tubers of potato plants grown solid was ever below than those grown under thin planting or under dense planting of the shade crop. The effect of altering population and stand geometry of the shade crop was coincided with the plant population density of the shade crop on the fresh weight of tuber. Rectangularity of the shade crop had also a favourable effect on tuberization as compared with squareity whether under thin or dense planting of the shade crop.7-Fresh weight of tubers / fresh weight of total plants decreased with increasing plant density of maize up to the heaviest. The ratio under extreme thin planting of the shade crop slightly surpassed the ratio of solid potato planting. These emphasize that irridiance is positively correlated up with tuberization till 7350-7400 f.c./m2 (till 25% of maize population in the association), thereafter tuberization gradually decreases under the Egyptian environment.2- Yield and yield components1- The data indicated that no any intercropping treatment within dense or shade treatments could catch up in number of tubers / plant with those of the check plants. On other hand, the average number of tubers per plant of potato grown under thin shade treatments exceeded that grown under dense shade treatments. There were also gradient increases in the average number oftubers per plant with diminishing shade intensity in the associations. Tuberization maximized when potato plants were exposed to high solar irridiant.2-The data revealed that the average number of large tubers within any intercrop treatment under shade treatments was less than that of the check plants. The data also revealed that potato plants grown under thin planting of the shade crop had more large and medium tubers in comparison with those grown under dense planting of the shade crop. On other hand, the trend was reversed in case of small tuber assay. The data also revealed that the average number of large and midium tubers increased linearly with diminishing plant population of the shade crop within both series of shade treatments and up to potato plants grown under full irridiance of the sun.3-Percent of large (> 50 mm) and medium (50 -30 mm) tubers of potato plants grown in the check plots were ever higher than those in the intercrop treatments. The data also revealed that the percent of large and medium tubers of plants grown under thin shade crop was higher than those recorded under dense shade treatments.4-Data indicated that potato grown under thin plant density of the shade crop outyielded potato grown in pure stand, but, those grown under dense shade crop yielded less than the potato grown under full sunlight.The data also evidenced that there were gradient increases in potato yield as the shade crop intensity decreased. Potato yields indicate different responses as influenced by plant geometry as well as plant population densitySUMMARE 150of the shade crop. Potato yield gradually increased with increases in the degree of rectangularity.3-Varietal response of potato.1- Plant height, average number of branches / plant, fresh weight of shoot/ plant, fresh weight of shoot / fresh weight of total plant, fresh weight of shoot/ fresh weight of stem and the dry weight of total plant of Diamont variety were ever superior to Spunta variety, whereas, fresh weight of total, plant fresh weight of tubers per plant and fresh weight of stems / fresh weight of total plants of Spunta variety were higher than that of Diamont indicating that potato cv- Diamont tended toward vegetative growth.2-Yield data also indicated that Spunta was superior to Diamont variety.4-Varietal response to intercropping1-Growth characters, i. e, plant height, average number of branches/ plant, fresh weight of shoot and dry weight of Diamont plants were relatively higher than those recorded for Spunta plants. While data evidenced copious growth associated with Diamont variety, Spunta was characterized with higher fresh weight of tubers whether under different plant population densities of the shade crop or potato grown soley.2-The average number of total and different tuber sizes and the actual yield per fed of both varieties when grown in pure stand were similar to little more or less than potato grown under thin planting of the shade crop and up to 50 percent shading. Thereafter, yields of both varieties were lower than yield of solidpotato up to the heaviest shade treatment, i. e, 100 shade crop density. Values of yield of Spunta exceeded that of Diamont variety under all shade treatments.3- Yield and yield components of potato intercropped with maize were positively correlated with diminishing the density of the shade crop down to the most thin planting of maize (25% of the shade crop density). At the same time, positive responses were also associated with

increasing rectangularity of maize orientation, i. e, with decreasing maize ratio in the intercrop whether within thin or dense planting of the shade crop. These results were valid with both varieties.5- Effect of row direction1-Potato height when ridges were oriented East- West were in general relatively higher than those orientated North - South. The data also revealed that where ridges were orientated from North to South, the average number of branches / plant were significantly increased and exceeded potato grown on ridges orientated East - West.2-Fresh weight of total plant and dry weight of shoot of potato grown North - South ridges were significantly higher than those raised on East - West ridges. On other hand, fresh weight of shoot per plant behaved the converse, i.e., the fresh weight of shoot of plants grown in North - South was significantly lower than potato plants grown on East - West ridges.3-The data, on other hand, indicated increased tuber weight when plants were grown on North - South ridges.4-Data on yield components of potato revealed that row direction had significant effect on these traits. The average number of tubers / plant increased in favour ridging on North -South. The data also revealed that growing potato on North -South ridges were associated with significantly higher total number of large, medium and small size of potato tubers as compared with growing potato on East - West ridges. The increase were more evident with medium size in both directions being little higher when growth on North - South ridges.5-The data also revealed that potato yield / fed grown on North -South ridges was significantly higher than that grown on East -West ridges.H- EFFECT ON MAIZE 1-Effect on growth traits1-Data indicated that there were gradual increases in plant height of maize with increasing plant population density of maize. Whithin thin planting of maize, the more squancity configuration as a result of increased alternative maize ridges, the more the shade associated with higher maize heights. On other hand with dense planting of the shade crop, the more squaricity configuration (as a result of increased maize plants in the association) was the more higher maize plants were obtained. But, neither any association of the thin shade treatments has had a stimulating effect on maize to catch up in height with maize plants grown alone.2-There was gradual increase in height of top most ear with increasing plant density of maize up to the heaviest shade. It isalso evident that there was a slow down in barrenness when decreasing the number of maize ridges under thin planting of the shade crop or under dense planting system. The percent of double ear plants tended to increase with reducing the number of maize ridges in thin associations as well as reducing maize density in dense planting of the shade crop. Percent of double ear plants when maize was grown under thin population exceeded those grown under dense population.2- Effect of intercropping on leaf area index, leaf area and light intercepted by maize foliage1-Leaf area of maize averaged over the lower strata (consisted of three lower leaves) were governed by maize density in the intercrop treatments, i. e, increased in almost cases gradually with increasing maize density.2-The data also indicated that leaf area indices were in accordance with leaf area in both row orientations. Least value of leaf area index was recorded with least shade treatment i. e, (1:3). Gradual increases were associated with increasing plant population density up to the heaviest. Moreover, values obtained under East - West ridging were little lower than those obtained under North - South ridging.3-Data on the extinction coefficient revealed that light penetrated to the base of maize under different shade treatments was concordant with k values. The results revealed that K values increased consistently with diminishing the shade crop density and consequently increased light penetration and light absorption by lower strata of maize leaves. The data also revealed that Kvalues were also governed with the geometric distribution of maize in the field, i. e, values when maize plants were arranged in rectangularities were ever superior to those orientated in squaricity, lower K values were recorded when maize was orientated from South to West.3- Effect on yield and yield components1-Maize yield components when the crop was grown in thin planting was superior to that grown in dense planting. The data also revealed that almost values of yield components of maize grown alone were lower than those of maize in thin shade treatments.2-It is also evident that maize geometry per unit area plays an important role in optimizing the favourable conditions predisposed by the intercropping pattern and maize arrangement i.e., maize yield components values increased with increasing maize density in the associations whether in dense or thin shade treatments. Data also revealed that solid planting of maize was associated with lower values of all yield components as compared with those of maize in thin planting. from another angle, the more rectangularity with decreasing

maize ridges or maize population in the alternative system in thin and dense planting was the higher values of these traits were obtained.3-No any shade treatment whether within thin or dense planting of maize yielded more than maize grown in pure stand. Grain yield/ fed of maize was not influenced by the geometry of maize plants in the associations. Yield of maize was not in favour ofSUMMARE 155rectangularity but was tenciously bounded with maize population density.4- Effect of potato variety on maize growth, yield components and yield of maize.1-Data evidenced that all values of maize growth were slightly diminished when Spunta potato was grown in the associations as compared with potato cv. Diamont.2-The effect of potato varieties on maize yield components was not measurable and the trend was inconsistent and irregular.5- Effect of row direction on growth, yield components and yield of maize.1-The effect of row direction on growth characters of maize was not statistically significant except in cases of the average number of leaves and ear position. Both traits of maize plant grown on North-South ridges were superior to those grown on East- West ridges. Double eared plants tended to follow the same trend. On other hand, the trend was conversed in case of the percentage of barren plants.2-Data on yield components of maize indicated that all values of these traits when maize was grown on North-South ridges were higher than those of maize grown on East-West ridges, but the course of significancey was variable.HI-COMPETITIVE RELATIONSHIPS AND YIELD ADVANTAGES1- Data on the mean relative yield of potato under thin shade treatments were higher than that recorded under dense shadetreatments. The data also indicated that Ryp grown under least maize density were the highest, thereafter (Rys) of potatodecreased gradually with increasing maize density. The increases in (Rys) of maize with increasing maize density up to 100%maize density was also evident.2-Data on land equivalent ratio revealed that the average values of LERs of all shade treatments achieved yield advantage as compared with the solid planting of either crop. Within thin shade treatments, there were gradual increases in LER with increasing maize density, whereas, under dense shade treatments a slow down observed under 67 percent maize density, then, increased at 75% and finally another slowdown at 100% maize density. Plant geometry of both components as well as the intercropping patterns had prime factors influencing land equivalent ratios.3-The total relative crowding coefficient under dense shade treatments behaved indvidually. All K values were above the unit and achieved yield advantage in comparison with solid planting of either component.4-The average values of agressivity for both categories of shading treatments, i. e, thin or dense shade treatments were not great enough to threaten successful intercrop associations. Agressivity pressure in case of heavy shading treatments were higher than those of thin shading treatments. Maize in all cases was the dominant component, whereas, potato was the dominated.5-Competitive ratio (CR) data indicated that maize was always more competitive than potato. In all treatments, CR values of maize exceeded the unit whereas CR values of potato were below the unit. There were declines in CRp values with decreasing the shading crop density up to the lowest within the thin shade treatments whereas CRm values behaved the converse. On other hand CRs values within dense shade treatments were inconsistent and irrigular.6-Data on area time equivalent ratio (ATER) indicated lower values than those recorded on LERs. All values of the intercropping treatments evidenced yield disadvantage in both season. There were consistent increases in ATER values with increasing maize density up to the heaviest. ATER values of heavy shading treatments were always higher than those of thin shading treatments.7-Data on the mean values of LER + ATER indicated moderate values (in between the higher values of LER and the lower values of ATER). Data revealed that all values obtained were higher than the unit indicating yield advantage due to intercropping. There were consistent and gradual increases in these values with increasing maize density up to 75% maize density in both seasons.8-The average values of CU.s of grain maize of dense shade treatments were much higher than those of thin shade treatments. whereas cereal units produced from tuber yield of thin shade treatments exceeded those obtained from dense shade treatments. There were consistent increases in the cereal units produced from maize grain with increasing maize densities in theassociation as well as consistent decreases of cereal units produced from potato as maize density in the associations increased. Highest total cereal units produced per fed were produced from 75 percent maize density.IV- ECONOMIC EVALUATION OF INTERCROPPING POTATO WITH MAIZE.1-Data on the net return sowed higher values of dense

shade crop treatments than that obtained from maize grown in pure stand and approximately equal to that obtained from potato grown in pure stand in 1997 season, but with slightly lower net return than potato grown alone.2-Net return of thin shade treatments exceeded that obtained from maize or potato alone. There was no relevance between LERs values of the shade treatments and the net return, except, that all lower values of LER of the thin shade treatments were associated with relatively higher values of net return. Least net return was associated with most dense shade treatment, whereas, the maximum was associated with least shade treatment. Positive correlation between diminishing population density of maize and increasing the net return was observed.3-Monetary advantage data revealed inconsistent trend within both dense or thin shade treatments. But least value of M.A was associated with potato grown under full maize density (100%).4-Profitability increased with diminishing the population density of maize was mainly dependent on potato productivity.