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Effects of Drought and Heat on Peanut (*Arachis hypogaea,* L.) Production

Examples of effects by drought and heat: vine drying (left), pegs not entering the ground (center), and spider mite infestation (right).

For high yields, peanut requires adequate soil moisture received either as rainfall or irrigation. Figure 1 shows the close relationship between rainfall and pod yield in 30 varieties tested in 2009 and 2010 in PVQE trials in Virginia and North Carolina. Critical peanut growth stages to drought are emergence, flowering, pegging, and pod filling. Heat will exacerbate drought effects at all stages and will increase soil moisture loss through evaporation. It is important that emergence is uniform and crop establishment is good. After emergence and until flowering soil moisture could be moderate and irrigation is not necessary unless it is very dry. If it is a very dry year, then limited irrigation can be applied between emergence and flowering, but not full irrigation. Limited moisture at this time will actually benefit plants as it will allow them to ‘acclimate’ and become better prepared for a drought season. Not only yield is affected by drought, but also the grading factors, in particular the content of Fancy Pods, Extra Large Kernels (ELK), Sound Mature Kernels (SMK), and Damaged Kernels (DK). Reduced grading factors will negatively impact the crop value. For example during extreme droughts, aflatoxin producing fungus (*Aspergillus flavus*) may develop and DK content may exceed 2.5%; in this case peanuts will be graded as segregations 2 and 3, and farmers will only receive 35% of the cash of segregation 1 peanuts. Therefore, in severe drought situations irrigation will help yield and grading factors of peanut. We found that irrigation helps peanut production even in ‘normal’ years for this area, when only sporadic droughts may occur around flowering and beginning pegging (Table 1). Major yield losses can occur due to drought effect on maturity, when plants may produce apparently two distinct crops (Figure 2). In this case, farmers will have a difficult time to decide when to dig and most of the time a good percentage for the black and brown pods will be shaded in waiting for the white and yellow ones to ripen. Taking into consideration that the brown and black pods have higher SMK than yellow ones, grading due to SMK content can be affected too.

Water is critical for peanut production also because it allows better use of the inputs. For example, water is needed to move calcium (Ca) from land plaster into the pegging zone and to keep soil Ca in solution and available to the pods. Water from rainfall or irrigation also improves the effectiveness of herbicides, fungicides, and insecticides. Without timely rain or irrigation, these inputs can be wasted. Soil moisture lowers soil temperatures, which allows for normal peg development and greatly reduces aflatoxin risk. Water is also the best insect control available in that it makes the peanut plant much less susceptible to some of the most costly pest such as cornstalk borer, burrower bugs, corn earworm, and spider mites.

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When rainfall is scarce and irrigation is not available, drought tolerant varieties should be used in particular in fields that historically are more prone to drought stress. There is limited information on which virginia-type varieties are drought tolerant. It is necessary to remark that drought has different facets depending on the region and year. It is, therefore, reasonable to speak about ‘droughts’ and know the response of varieties to the particular fields and regions in which they are grown. Until now, we don’t know which are the most tolerant peanut varieties grown in southeastern Virginia. Speculations were made that runner-type varieties are, in general, more tolerant to drought than the virginia-types, but this has not been documented for our region either.

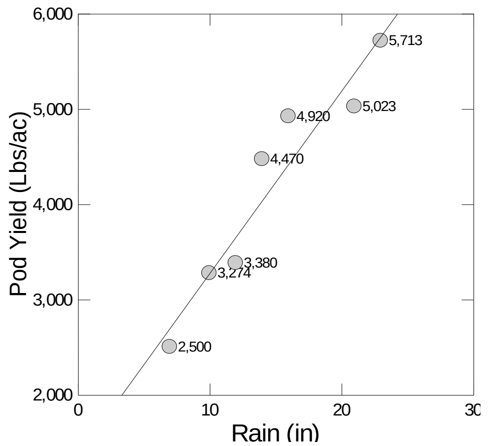

Figure 1. The dependence of yield on the amount of water received from planting to maturity.

Treatment	Fancy Pod	ELK	DK	SMK	Pod Yield	Value
	%				lb/A	$/A
Experiment 1						
Dryland	85	39	1.9	64	3631 b	618 b
Irrigated	88	44	1.7	68	4151 a	744 a
Experiment 2						
Dryland	78	39	1.9	63	6483 b	888 a
Irrigated	80	43	2.4	65	6870 a	849 a

Table 1. Effects of irrigation on yield, value, and grading factors of peanut. Data obtained from two independent studies in 2011. Values followed by the same letters within each column are not statistically significant at P = 0.05 based on Fisher’s protected LSD test.

Figure 2. Crop split due to moisture stress in peanut.

Figure 3. Experimental peanut plots to study drought under rain exclusion shelter at TAREC in 2012.

In 2012, two experiments were initiated at Tidewater AREC to study which are the most drought tolerant varieties and by which mechanisms. Knowing which mechanisms make peanut varieties better withstand drought can be further used by breeders to develop more drought tolerant varieties in the future. We are pleased to work on this project with faculty and graduate students from VT and NCSU, and in particular with the peanut breeder at NCSU, Dr. Tom Isleib, and wild peanut breeder, Dr. Shyam Tallury.