

Blackhawk Arrowleaf Clover

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Blackhawk arrowleaf clover (*Trifolium vesiculosum* Savi) was developed through recurrent selection for tolerance to the fungal soil pathogen *Pythium ultimum* and for tolerance to Bean Yellow Mosaic Virus (BYMV). This new arrowleaf clover cultivar was developed in the Forage Legume Breeding Program at the Texas A&M AgriLife Research and Extension Center at Overton. The origin of this line traces back to dark-seeded half-sib lines from 1984 field selection nurseries planted to individual plants of the arrowleaf cultivars Yuchi, Amclo and Meechee. Blackhawk seed are 95% black with only slight variation in degree of dark color. The black seedcoat of Blackhawk arrowleaf has been associated with tolerance to *Pythium ultimum* in our trials and further research is in progress to determine the genetics of this seedcoat color trait. A number of studies have demonstrated the protective effect of seed coat pigments in legumes against soil pathogens (Bateman, 1989, Stasz et al 1980, Kraft 1977). Dark-seeded genotypes show increased tolerance to fungi such as *Pythium ultimum* and *P. irregulare*, when compared to light colored seeds. The protective pigments are anthocyanins, which are also found throughout plants in flowers, leaves, seed, etc. Anthocyanins are seen as shades of red, purple, pink, orange, and blue. Blackhawk is highly tolerant of *Pythium ultimum* and in contrast, Yuchi and Apache arrowleaf clover are highly susceptible to this fungal disease. BlackHawk is also resistant to BYMV-induced lethal wilt and shows tolerance to the other components of BYMV disease. Blackhawk is slightly earlier in maturity than Apache arrowleaf and is in full bloom around May 10 at Overton, TX.

Arrowleaf Clover Background and Breeding for Disease Resistance

Arrowleaf clover is a robust, high yielding annual clover that is well-adapted as an overseeding component of perennial warm-season grass forage systems used across the US southern region (Knight 1970; Rouquette and Smith 2010). This clover is productive later in the spring (March – May) contrasted to crimson clover (*Trifolium incarnatum* L), which flowers and ceases growth in mid April. Arrowleaf clover was widely used in the US southern region in the 1960's and 1970's. Various disease and pest problems were reported on arrowleaf clover (Gibson et al., 1979; Pratt et al., 1982) and forage production from the varieties Yuchi, Amclo and Meechee was unreliable by the late 1970's. A breeding program was initiated at the Overton Research and Extension Center in 1979 to develop improved, disease resistant arrowleaf clover cultivars.

Fungal pathogens in the soil can also attack arrowleaf clover and cause damage at different growth stages (Pemberton et al, 1998). *Pythium ultimum*, *P. irregular*, *Rhizocotonia solani* AG4 and *Fusarium proliferatum* were shown to infect, kill or damage germinating seed and emerging seedlings of arrowleaf clover. *Pythium ultimum* was noted to cause particularly severe symptoms, often resulting in 100%

death of arrowleaf clover seedlings. A seedling screening method was developed to assist in selection and breeding of arrowleaf clover for tolerance to this fungal pathogen. Blackhawk arrowleaf clover was developed using dark-seeded germplasm and recurrent selection for both virus tolerance and *Pythium ultimum* tolerance. Blackhawk was released as a cultivar by Texas A&M AgriLife Research in Jan. 2013.

Comparison of Arrowleaf Clover Cultivars

	Blackhawk	Apache	Yuchi
Virus Tolerant	Yes	Yes	No
Fungal Disease Tolerant	Yes	No	No
High Yield	Yes	Yes	Yes (if disease free)
Maturity	Early	Medium	Late

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- Stasz, T.E., Harman, G.E., Marx, G.A. 1980. *Phytopath* 70:730-733. Pea seed coat containing anthocyanins were resistant to *Pythium ultimum* seed and seedling diseases.