Weeds x Water: An Approach to Integrated Weed Management

Becky Bowling, PhD Assistant Professor & Extension Urban Water Specialist



Outline



INTEGRATED WEED MANAGEMENT AND CULTURAL CONTROL: A REVIEW



WATER, WEED ECOLOGY AND INDICATOR WEEDS

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WATER AND HERBICIDES



INTEGRATED WEED MANAGEMENT (IWM)

Responsible sourcing of seed, sod, compost, mulch and other introduced material that may contaminate the landscape with new weeds.





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Manual removal (handpulling), mowing, or the establishment of physical barriers to inhibit weed growth including the use of mulch, landscape fabric and even fencing.

Biological Control

Can refer to the introduction of natural predators to impede weed growth or preferentially feed on weeds.

Refers to the use of both natural and synthetic herbicides including preemergence, postemergence , systemic and contact herbicides

Control

emical

Cultural and Mechanical Control: Select Review & Updates

THE BEST DEFENSE AGAINST WEEDS IS A HEALTHY, DENSE STAND OF TURFGRASS



Plants need water.

Choose the right turfgrass.



BЧ **DROUGHT TOLERANCE**



Buffalograss

Bermudagrass

Zoysiagrass (Z. japonica)

Bahiagrass

St. Augustinegrass**

Zoysiagrass (Z. matrella)

Centipedegrass

NEW: NTEP Turfgrass Trial Explorer

https://maps.umn.edu/ntep/



1. Choose cultiv	ar or trial			Help
Select a cultivar OR 2018 Warm-Season Water	Use Drought - 2020	~	~	
2. Choose varial	ole(s)			Variable guide
GENETIC COLOR GREENUP WINTER COLOR Show results for individual s	vears (1 variable only)? haracteristics	∵Yes ®No and managem	ent practice	s (optional)
Expand/Collapse options				
STATE Mississippi New Mexico Oklahoma Texas	SOIL PH 4.6 - 5.5 6.1 - 6.5 6.6 - 7.0	SOIL TEXTURE Sand Loamy sand Sandy Ioam	SHADE Full sun	IRRIGATION PRACTICED No irrigation
PHOSPHORUS (i) 0 - 60 61 - 150 271 - 450	NITROGEN (I) 0 - 1.0 2.1 - 3.0 3.1 - 4.0	POTASSIUM (i) 0 - 150 241 - 375	MOWING HEIGHT 0 - 0.5" 0.6 - 1.0"	TRAFFIC DESIGNATION

♦NTEP Entry Name	Table avg	Lexington Rainout shelters, KY
c.v.	35.4	35.4
LSD	2.8	2.8
ASC 118	4.7	4.7
ASC 119	2.7	2.7
Cody	4.7	4.7
Dog Tuff	6.3	6.3
FAES 1306	3.0	3.0
FAES 1307	4.0	4.0
FB 1628	5.3	5.3
Meyer	6.0	6.0
Monaco	4.7	4.7
OKC 1221	7.0	7.0
Premier Pro	4.7	4.7
Prestige	4.7	4.7
Rio (JSC 2009-6-s)	4.0	4.0
Stellar	4.3	4.3
Tahoma 31	6.0	6.0
TifTuf ™	6.3	6.3
Tifway	5.0	5.0

- Low-Input (Cool/Warm)
- Water Use/Drought (Cool/Warm)
- Drought tolerance as a parameter of species reports



https://www.tgwca.org/

WCA uses peer review of objective data collected through multi-year, multi-site trialing to qualify the most rought tolerant cultivars of each turfgrass species.

ualification in TWCA is time limited and progressive; meaning each cultivar must either re-qualify against a ew, higher standard of drought tolerance or lose its use of the seal.

order for a turf grass consumer product, blend, or mixture to be qualified to use the TWCA label, a nimum of 70% of the varieties included in that product blend or mixture must be TWCA qualified.

FIND TWCA Qualified Products

Use the TWCA product locator to find the drought tolerant turf solutions you need! The simple key makes it easy to find the product you need!



Indicates a Seed Producer Member of TWCA. These members produce seed through farm partnerships.



Indicates an Industry Member whose main commercial interest in TWCA is seed products.



Indicates an Industry Member whose main commercial interest in TWCA is living sod products.



What about in landscape beds?



Wood and other plant-based mulches may offer some of the greatest benefits:

- Natural
- Decompose, contribute to soil ecology and organic matter
- Can have an allelopathic effect (chemically killing or suppressing some weeds)

Rock mulches will stand the test of time, but may create other challenges with heat and bed management.

What about landscape beds?



Similar to turfgrass, **dense**, **spreading ornamental plant materials** can suppress weed activity by shading soil and competing more aggressively with potential invaders.

Live vegetation offers other benefits as well:

- Water quality protection
- Improved infiltration and water capture
- Support of wildlife

Go **native & adaptive** to reduce supplemental watering requirements.



COMMON IRRIGATION PROBLEMS

Things to avoid

- Over-watering
- Improper Design and Installation
- Improperly-scheduled practices
 - \circ $\,$ Time of day $\,$
 - \circ Time of year
 - \circ Frequency/Duration
- A lack of routine maintenance

AVERAGE WEEKLY WATER REQUIREMENT BY MONTH

https://texaset.tamu.edu

_	- /							
	-	Apr	May	June	July	Aug	Sept	Oct**
	Amarillo	GNR	0.8	1.1	1.1	1.0	0.8	0.5
	Austin	GNR	0.9	1.0	1.0	1.0	0.8	0.6
	Corpus Christi	0.7	0.8	0.9	0.9	0.9	0.7	0.6
	DFW	GNR	0.8	1.0	1.0	1.0	0.8	0.6
	El Paso	GNR	1.3	1.6	1.2	1.2	1.1	0.8
	Houston	0.7	0.8	0.9	0.9	0.8	0.8	0.6
	Lubbock	GNR	0.9	1.1	1.0	1.0	0.8	0.6
	San Antonio	GNR	0.9	1.0	1.0	0.9	0.8	0.6

- GNR = Generally not required.
- In many parts of Texas, warm-season turfgrass does **not** need to be watered during winter months.
- Transition months in the spring and fall should be months when turf is watered manually to prevent over-watering.
- Irrigation should *always* be adjusted based on natural rainfall.

Is twice per week watering good enough?

Once per week?

Less?

ON AVERAGE, 30 TO 50% OF POTABLE WATER IS USED IN THE LANDSCAPE.



AS MUCH AS 50% OF THAT MAY BE LOST AS RUNOFF.

United States Drought Monitor



United States and Puerto Rico Author(s):

Pacific Islands and Virgin Islands Author(s):

https://droughtmonitor.unl.edu/

Drought Contingency Planning: Critical Knowledge Needs



Photo: USGA | Broadmoor GC

- 1. Potential watering restrictions.
- 2. Precise knowledge of irrigated acreage.
- 3. Knowledge of monthly water use for each area.
- 4. Detailed knowledge of irrigation system output, operation, and capabilities.
- 5. Identification and labeling of highpriority areas required to maintain playability.

WATER DEEPLY AND INFREQUENTLY

Watering deeply (~6 inches) and less frequently promotes deeper, more vigorous root growth.



CYCLE AND SOAK

Program irrigation systems to cycle 2 to 4 times with 30-60 minute rests.



MONITOR CLOSELY

Checking irrigation system performance on a regular basis is important to keep small problems from becoming BIG, expensive and wasteful problems.





WATER EARLY IN THE MORNING

•Midday watering leads to greater evaporative losses.

•Evening watering prolongs the period of leaf wetness. This can create conditions that promote disease.



SUPPLEMENT WITH RAINWATER

- Using rainwater can help conserve water by reducing the use of potable water.
- The quality of rainwater is often better than some irrigation sources.

SPATIAL VARIABILITY: SOIL MOISTURE





Straw, C. M., Grubbs, R. A., Tucker, K. A., & Henry, G. M. (2016). Handheld versus mobile data acquisitions for spatial analysis of natural turfgrass sports fields. *HortScience*, *51*(9), 1176-1183.

SPATIAL VARIABILITY: TURF VIGOR (NDVI)





Straw, C. M., Grubbs, R. A., Tucker, K. A., & Henry, G. M. (2016). Handheld versus mobile data acquisitions for spatial analysis of natural turfgrass sports fields. *HortScience*, *51*(9), 1176-1183.



WATER QUALITY

Irrigation water quality has significant impacts on turfgrass systems:

- Nutrient management
- Salt Stress
- Soil Structure

WATER, WEED ECOLOGY AND INDICATOR WEEDS

WEED ECOLOGY

The study of the interaction or relationship between a weed and another plant and its environment.

Characteristics that support weediness:

- Rapid seed germination
- Rapid growth
- The ability to take up and utilize large amounts of nutrients
- Prolific seed production
- Seed characteristics that promote dispersal
- Seed dormancy mechanisms
- Continual flushes of germination
- The ability to adapt to various environmental conditions
- High tolerance to stresses

INDICATOR

weeds that may indicate environmental or soil conditions affecting turfgrass/plant health and driving weed proliferation



INDICATOR WEEDS

WHAT MIGHT BE INDICATED?

- pH Imbalances
- Fertility Imbalances
- Water Issues (too much or too little)
- Soil Compaction
- Improper Mowing Height
- Excess Shade
- Salinity

INDICATOR WEEDS – EXCESS MOISTURE



Sedges like yellow and purple

nutsedge, annual flatsedge, and



Water Hyssop



Virginia Buttonweed



Dollarweed



When these weeds dominate a part of your landscape, it may be a sign of over-watering, malfunctioning irrigation equipment, low spots, heavy soils and/or poor drainage.

3



Annual Bluegrass



INDICATOR WEEDS – DROUGHT/HOT



Black Medic



Common name: Sandbur Latin name: Cenchrus spinifex Cav.



Common name: Smooth Crabgrass Latin name: Digitaria ischaemum (Schreb.) Muhl



Common name: Dallisgrass Latin name: Paspalum dilatatum Poir.



Common name: Khakiweed Latin name: Alternanthera pungens Kunth



Common name: Western Horsenettle Latin name: Solanum dimidiatum Raf.



Common name: Shepherd's-purse Latin name: Capsella bursa-pastoris (L.) Medik.



Common name: Purslane Latin name: *Portulaca oleracea* L.

INDICATOR WEEDS: SOIL COMPACTION



Common name: Common Chickweed Latin name: Stellaria media L.



Common name: Goosegrass Latin name: *Eleusine indica* (L.) Gaertn.



Common name: Dandelion Latin name: Taraxacum officinale F.H. Wigg



Common name: Prostrate Knotweed Latin name: Polygonum aviculare L.



Common name: Yellow Woodsorrel Latin name: Oxalis stricta L.



Buckhorn Plantain



Common name: Field Bindweed Latin name: Convolvulus arvensis L.



Curly Dock

SOIL MOISTURE & WEED SEEDS



THE EXAMPLE OF SANDBUR

Cenchrus spp.

Burs can **absorb and retain soil moisture** Distinctions are obtimal for Butrient and moisture levels can significantly help to prevent sandbur

infestations it to **easily** take over sparse, poorly-managed turfgrass areas on dry, This may include amending soil with highquality organic matter to improve nutrient and water-holding capacity.



THE EXAMPLE OF ANNUAL BLUEGRASS

Poa annua L.

Poa annua L. Seedling Emergence Pattern vs. Soil Moisture Zone 8b



Poa annua L. Seedling Emergence Pattern vs. Soil Moisture Zone 9a 300 0.35 m²) 0.3 0.25 (m², m²) 0.2 m² (m²) 0.15 0.1 0.1 0.05 0.3 250 seedlings 200 ę 150 Emergence (# 100 50 0.05 6 North 3 North 3 North ADEC 1 DEC 19 DEC 19 DEC 19 DEC 1 DEC 19 DEC 1 DEC 19 D 2.180.29.180.29.54.80.20.14.80.29 20 19 Feb 20 19 Feb 20 AMBI 20 Zone 9a Emergence Zone 9a Soil Moisture

WATER & HERBICIDES

HITTING YOUR TARGET: PRE vs. POST



[®]Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

For preemergence residual control of crabgrass, apply at least 0.5 inch of water after application; but in order to optimize postemergence control delay irrigation for 6 hours after application.





PROGRAM <u>FAILURE</u>

- Reduced Efficacy
 - May not find out until it's too late
- Wasted time, money, labor
- Risk of overcompensation
- Limited by Maximum Annual Use Rate
- Pooling elsewhere may increase risk of phytotoxicity

Drought and Herbicide Efficacy



- Drought may prolong soil residual activity.
- Stressed plants are often harder to kill.
- Drought can alter plant architecture, leaf surfaces and spray droplet behavior
 - Wilt and leaf droop can alter coverage potential
 - Extended drought can create barriers that are more difficult for herbicides to penetrate
- Drought can alter soil physical properties affecting movement and uniformity of some products.

Drought and Herbicide Efficacy



Under conditions of drought:

- Aim to make herbicide applications within a few days of a rainfall or irrigation event when weeds may be more physiologically active.
- Consider morning applications
 - Weeds are more hydrated
 - Spray droplet performance may be better
- Consider spray adjuvants such as methylated seed oil (MSO) and similar products that may penetrate leaf barriers.

Preemergence Efficacy and Saturated Soil Conditions

		Approximate	Approximate
Active Ingredient	Trade Name	Half-Life in Moist	Half-Life in
		Soil	Saturated Soil
Indaziflam	Specticle	120 days	120 days
Oryzalin	Surflan AS	45 days	5 days
Oxadiazon	Ronstar	60 days	30 - 60 days
Pendimethalin	Pendulum	45 days	12 days
Prodiamine	Barricade	56 days	28 days



Table created by: Travis Gannon, PhD | NC State

Numbers are relative estimates, and can be heavily influenced by environmental conditions.

- Saturated soil conditions (waterlogged, flooded) may adversely affect preemergence herbicide performance.
- Limited oxygen in these soils can speed up degradation of some herbicide products.

If conditions are saturated or there has been heavy rainfall:

- Monitor closely for weed breakthrough
- Consider increasing active ingredient rate in sequential applications
- Have postemergence herbicides ready

OFF-TARGET MOVEMENT

The movement of a herbicide "off-target" leading to less effective control, increased risk of environmental hazard, and accidental injury of non-target organisms



INJURY

Deformed foliage: leaf cupping, curling, twisting, puckering, strapping (narrow, elongated growth)
Deformed stem and branch growth: Twisted, curled or stunted
Clusters of stunted shoots or leaves
Discolored foliage: yellow, white, reddish, purplish, or abnormally light or dark green

•Leaf scorch: leaf edges turn tan to brown, flecking, or complete browning and death of leaves

•Defoliation: leaves or needles drop from the tree

- Branch dieback
- Death

HERBICIDE MOVEMENT: RUNOFF



ENVIRONMENTAL HAZARDS

This product is toxic to fish, aquatic invertebrates, and plants. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean watermark. Do not contaminate water when disposing of equipment rinsate or washwater. This product may enter water through spray drift or runoff. Follow directions for use to avoid spray drift and runoff. A level well maintained vegetative buffer strip between areas to which this product is applied and surface water features including ponds, streams, and springs will reduce the potential for getting into water from rainfall-runoff. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur within 48 hours.

This product may enter water through spray drift. Follow precautions for use to avoid spray drift.

SOIL MOISTURE, IRRIGATION, AND RAINFALL AFTER APPLICATION

To activate SPECTICLE FLO HERBICIDE, irrigate lightly after application to move the herbicide into the soil. Rainfall within several days after application will negate the need to irrigate. Avoid application to saturated soil. Postpone application if rainfall that may cause visible run-off is anticipated.

HERBICIDE MOVEMENT: RUNOFF

	METSULFURON METHYL GROUP 2 HERBICIDE
s	Manor elective Herbicide
A Recomme	Water Dispersible Granule. nded for Use by Turfgrass Managers.
ACTIVE INGREDIENT: Metsulfuron Methyl: Methyl 2-[[[[(4-metho carbonyl]amino]sulfonyl]benzoate OTHER INGREDIENTS: TOTAL:	xy-6-methyl-1,3,5-triazin-2-y()amino] 60.0% 40.0% 100.0%
KEEP OUT	OF REACH OF CHILDREN CAUTION
SEE INSIDE BOOKLET FO For Chemical Spill, Leak For Medical	DR FIRST AID AND PRECAUTIONARY STATEMENTS , Fire, or Exposure, Call CHEMTREC (800) 424-9300 Emergencies Only, Call (877) 325-1840
EPA Reg. No. 228-373 Net Contents 8 oz. (236 mL)	Manufactured for Nufarm Americas Inc. 11901 S. Austin Avenue Alsip, IL 60803 Nufarm Grow a better tomorrow

TEEDS X WATERING

ENVIRONMENTAL HAZARDS

Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply where runoff water may flow, during periods of intense rainfall or to water saturated soils as off-target movement and injury may occur. Do not contaminate water when cleaning of equipment or disposing of equipment washwaters. Do not apply this product through any type of irrigation system.

Surface Water Advisory Statement: This product may impact surface water quality due to runoff of rain water. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having high potential for reaching surface water via runoff for several months or more after application. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of metsulfuron-methyl from runoff water and sediment. Runoff of this product will be greatly reduced by avoiding applications when rainfall or irrigation is expected to occur within 48 hours.

HERBICIDE MOVEMENT: VOLATILIZATIO



A selective herbicide for preemergence control of annual grasses and broadleaf weeds.

ACTIVE INGREDIENT:								
N-butyl-N-ethyl-a,a,a-trifluoro-2,6-dinitro-p-toluidine	 	 	 	 	 			 60%
OTHER INGREDIENTS:	 	 	 	 	 			 40%
						TOTA	L	100%

Contains 0.6 pound active ingredient per pound.

Incorporation

Before planting, Balan DF must be incorporated one time within 4 to 8 hours after application. A second incorporation is required with most equipment (see "Incorporation Equipment" below for specific instructions). If Balan DF is applied to a wet, warm soil surface or if the wind velocity is consistently greater than 10 mph, variable weed control may result. Variable weed control may also result if incorporation is delayed more than 8 hours in the eastern United States or 4 hours in the western United States. Operate equipment to mix Balan DF into the top 2 to 3 inches of the final seedbed. Generally, incorporation equipment will mix Balan DF approximately half as deep as equipment is operated. For example, operating equipment 4 inches deep will mix Balan DF into approximately the upper 2 inches of the seedbed.

Special Note: In the western United States, extremely high temperatures and intense sunlight may be present at the time of application. Under such conditions, Balan DF should be incorporated within 4 hours after application to prevent loss of herbicidal activity.

A GRILIFE

THANKS!

Dr. Becky Bowling

<u>bgrubbs@tamu.edu</u> Follow me: @TXWaterWoman