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Postemergence Control of English Daisy in Cool-Season Turf 2021 Report

Pawel Petelewicz[1], Pawel Orlinski[2] and Jim Baird[2]
[1]Agronomy Department
University of Florida, Gainesville, FL
[2]Department of Botany and Plant Sciences
University of California, Riverside, CA
951-300-8848; petelewicz.pawel@ufl.edu
951-333-9052; jbaird@ucr.edu

The Bottom Line: Nineteen treatments containing commercially available herbicides were tested alone or in combination against a nontreated control for postemergence control of English daisy (*Bellis perennis*) in a mixed stand of perennial ryegrass (*Lolium perenne*) and annual bluegrass (*Poa annua*) maintained as golf course fairway. Study was conducted at the Napa Golf Course in Napa, CA. Treatments were applied three times every 4 wks. starting September 2020. Except for Turflon Ester Ultra alone, all treatments provided satisfactory target weed control exceeding 80%, in most cases achieving full eradication with practically no re-infestation until June 2021. Most rapid effect – almost 100% control at 4 weeks after initial treatment (WAIT) – was provided with all treatments containing Sapphire treatments, as well as all Pylex tank-mixtures (except for one with Turflon Ester Ultra). In all cases, addition of auxin mimicking herbicides (group 4) to a tank-mix accelerated and improved weed control, and Vista XRT was the most efficacious additive of all. While Sapphire caused unacceptable phytotoxicity to the desired sward persisting from 4 to 16 WAIT, injury from Pylex was never deemed unacceptable, except for when tank-mixed with Vista XRT (from 2 to 6 WAIT). These results suggest that Pylex and Tenacity can be used as safe alternatives to Sapphire – especially when paired with proper auxin mimicking herbicides (Drive XLR8, Vanquish, Vista XRT).

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Introduction

English lawn daisy or English daisy (*Bellis perennis*) was originally an ornamental species brought to California from Europe as a garden plant; however, it ultimately invaded turf and currently is one of the most difficult to eradicate perennial broadleaf weeds, especially in Northern California. English daisy spreads mostly by rhizomes and seed, and is adapted to a wide range of environmental conditions and cultural practices including cool, moist, shady environments on heavier, fertile soils. Plants are low-growing and can tolerate relatively close mowing (ca. 1 in.). English daisy has a prostrate or spreading growth habit and can stay hidden in the turf canopy until flowering occurs. Flowers are small and typical

for *Asteraceae*, white or pinkish with yellow centers. A single plant produces numerous flowers, disrupting turf uniformity.

English daisy is tolerant to many common broadleaf herbicides. Recent research identified penoxsulam (Sapphire), an acetolactate synthase (ALS) inhibitor, to provide effective control of this species. However, this herbicide can be injurious to perennial ryegrass, which is often the desired turf species invaded by English daisy. Additionally, the excessive use of single mode of action (MOA) herbicides may lead to the development of resistant populations. Identification of potential tank-mix partners enhancing the efficacy of penoxsulam, as well as the identification of its safe alternatives remains crucial.

Objectives

This study was conducted to evaluate a series of 3 sequential, monthly applications of Sapphire (penoxsulam), Tenacity (mesotrione), and Pylex (topramezone) in combination with Turflon Ester Ultra (triclopyr), Drive XLR8 (quinclorac), Vanquish (dicamba), or Vista XRT (fluroxypyr) for improved postemergence control of English daisy (*Bellis perennis* L.) in a mixed stand of perennial ryegrass (*Lolium perenne* L.) and annual bluegrass (*Poa annua* L.), maintained as a golf course fairway. Turf safety and longevity of the aforementioned treatments were also investigated.

Materials and Methods

The study was conducted from September 2020 to June 2021 at Napa Golf Course (Napa, CA; USDA plant hardiness zone 9b; 16.4 ft elevation). The turf was a mix of perennial ryegrass and annual bluegrass mowed 2 days per week at 0.5 inches. During the study the golf course utilized standard cultural practices for fairway maintenance.

Target weed was English daisy. Herbicide treatments were applied on September 30, October 27 and November 24, 2020, as described in Table 1. Non-ionic surfactant (NIS) at 0.25% v/v or methylated seed oil (MSO) at 0.5% v/v were added to the tank-mix as prescribed by the herbicide treatment. All herbicide treatments were applied using a CO_2-powered backpack sprayer (R&D Sprayers, Bellspray, Inc.) equipped with four TeeJet® 8002VS VisiFlo® flat-fan spray tips (TeeJet Technologies, Spraying Systems Co.) calibrated to deliver 1 gallon/1000 ft^2 of spray solution. No irrigation was applied to the treated areas and no precipitation occurred for at least 6 hours after herbicide application.

Evaluation was carried out on a biweekly schedule, starting on September 30, 2020, and ending on June 24, 2021. Over the trial duration, plots were visually evaluated for: English daisy cover (0-100%), target weed control expressed as the percentage of ratio between initial cover and cover at the time of evaluation (0-100%), turfgrass injury with herbicide treatments (0-10, 0 = no damage, 3 = maximum acceptable injury level, 10 = dead turfgrass).

Study design was a complete randomized block (CRB) with five replicates. Individual plot size was 4×4 ft with 1-ft alleys. Data collected throughout the study was analyzed using analysis of variance in Statistica 10 (StatSoft, Inc.) and the means were compared using the Fisher's protected least significant difference test at the 0.05 probability level.

Results

Except for Turflon Ester Ultra at 1 pint/A, all herbicide treatments eventually provided satisfactory target weed control exceeding 80%, whether used as standalone products or tank mixes. In most cases full eradication was achieved with practically no re-infestation until June 2021 (Fig. 2A).

Auxin mimicking (group 4) herbicides employed in this study (Turflon Ester Ultra at 1 pint/A, Drive XLR8 at 2 pints/A, Vanquish at 10 oz/A, and Vista XRT at 1.44 pints/A) were evaluated mainly for their ability to improve the efficacy of acetolactate synthase (ALS) and/or 4-hydroxyphenyl-pyruvatedioxygenase (HPPD) inhibiting herbicides (groups 2 and 27 respectively). However, their performance as standalone products was also evaluated. Drive XLR8, Vanquish, and Vista XRT resulted in satisfactory level of control (exceeding 80%) following the second application and starting from 8 weeks after initial treatment (WAIT), which persisted until the end of study. In addition, Vista XRT was the only group 4 herbicide which resulted in almost complete weed control (exceeding 95%) starting from 12 WAIT when used alone (Fig. 2A). No significant turf injury was observed with any of the standalone group 4 herbicides when compared to nontreated control (data not shown).

Among standalone groups 2 and 27 products, the most rapid target weed removal was provided with Sapphire at 0.5 pint/A, which resulted in almost full eradication (>95% control) at 4 WAIT with a single application. Follow-up Sapphire applications ensured complete weed removal starting from 6 WAIT. However, the third application did not seem necessary to achieve the same level of efficacy. The addition of group 4 herbicides, although slightly improving Sapphire's efficacy against English daisy, had no statistically significant impact on its performance (Fig. 2B). The use of Sapphire both as a standalone treatment or a tank-mix constituent resulted in unacceptable (above the score of '3') damage to the desired turfgrass sward which remained from 4 WAIT to 16 WAIT and was demonstrated by both direct injury to turf (growth regulation, discoloration, tissue damage) as well as by persisting voids after target weed removal (Figs. 3A and 5).

Initial Tenacity treatment at 5 oz/A did not trigger any significant target weed response (control below 10% by 6 WAIT). However, the 2 additional follow-up applications resulted in satisfactory control starting from 12 WAIT and complete eradication from 14 WAIT (Figs. 2C and 6). Standalone Pylex at 1 oz/A provided a satisfactory level of weed control starting from 6 WAIT (as a result of second application) and almost complete control starting from 10 WAIT (after third application). (Figs. 2D and 7).

The addition of auxin mimicking herbicides to both Tenacity and Pylex accelerated and improved weed control. In the case of Tenacity, all such additions resulted in a visibly higher level of target weed control with just one application. Both Drive XLR8 and Vanquish reduced the time needed for Tenacity to reach satisfactory control from 12 to 6 WAIT, and for complete control from 14 to 8 WAIT. The addition of Vista XRT was stronger and provided full eradication starting from 6 WAIT (Fig. 2C). In the case of Pylex, the addition of Drive XLR8, Vanquish, and Vista XRT shortened the time needed for total or almost full English daisy control from 8 to 4 WAIT (single application), while Turflon Ester Ultra control was reduced from 8 to 6 WAIT with a second application required (Fig. 2D). Although the difference was not always significant (i.e., numerically speaking) Vista XRT was the most powerful addition among the employed group 4 herbicides (Fig. 2).

Tenacity either alone or as a tank-mix constituent was not entirely safe to the desired turfgrass sward. Some injury (close to or exceeding the acceptable level) was observed with Tenacity-containing treatments following their second and/or third application, and in some cases such damage persisted for 2-6 wks. after treatment (Fig. 3B). Treatments containing Pylex did not cause the unacceptable turfgrass injury, except for Pylex + Vista XRT tank mix, from 2 WAIT to 6 WAIT (Fig. 3C).

While Pylex seemed to be safer and more effective, ultimately it was shown that multiple applications of both Pylex at 1 oz/A and Tenacity at 5 oz/A have the capacity to effectively control English daisy in mixed

cool-season turf and could therefore be used either as safer substitutions for Sapphire or included in rotation programs. Additionally, Drive XLR8 at 2 pints/A, Vanquish at 10 oz/A, and Vista XRT at 1.44 pints/A were identified as potential, safe, and efficacious components for tank mixing with Pylex and Tenacity. The study was repeated in 2021 to 2022.

Tables and Figures

Table 1. Herbicide treatments, tank-mixing setup, and timing (application dates) used in the study to evaluate postemergence English daisy (*Bellis perennis*) control and turf safety in mixed stand of perennial ryegrass (*Lolium perenne*) and annual bluegrass (*Poa annua*) maintained as a golf course fairway at Napa Golf Course, Napa, CA. 2020-21.

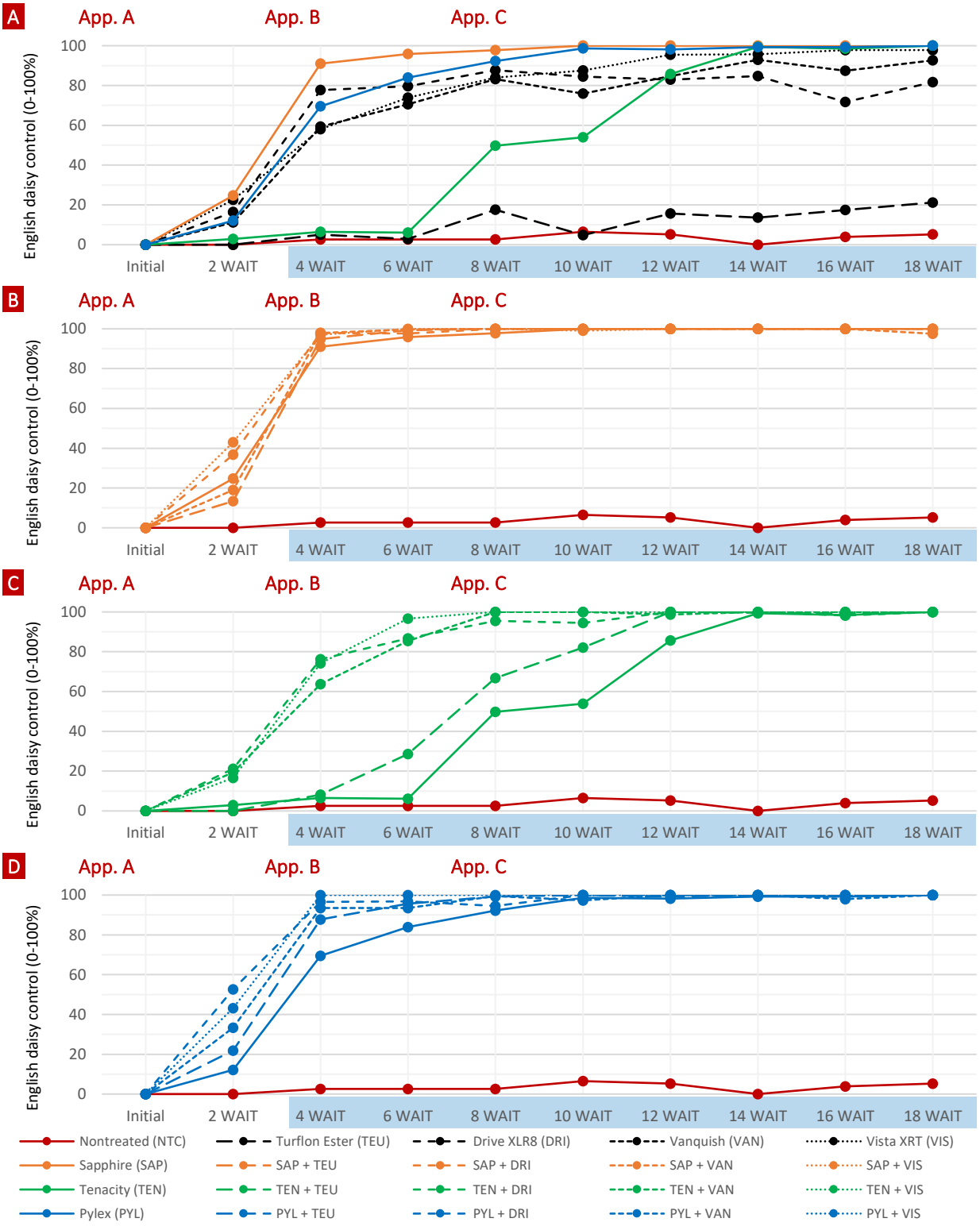
No.	Treatment	Active ingredient	HRAC MOA Group	Company	Rate		No. of apps	Freq. (wks)	Timing
1	Nontreated (NTC)	-	-	-	-	-	-	-	-
2	Sapphire (SAP)	penoxsulam	2	Corteva	0.50	pint/A	3	4	ABC
3	Tenacity (TEN)	mesotrione	27	Syngenta	5.00	oz/A	3	4	ABC
4	Pylex (PYL)	topramezone	27	BASF	1.00	oz/A	3	4	ABC
5	Turflon Ester Ultra (TEU)	triclopyr	4	Corteva	1.00	pint/A	3	4	ABC
6	Drive XLR8 (DRI)	quinclorac	4	BASF	2.00	pint/A	3	4	ABC
7	Vanquish (VAN)	dicamba	4	Nufarm	10.00	oz/A	3	4	ABC
8	Vista XRT (VIS)	fluroxypyr	4	Corteva	1.44	pint/A	3	4	ABC

Herbicide treatment			HRAC MOA Group 4				
			Nontreated	Turflon Ester Ultra	Drive XLR8	Vanquish	Vista XRT
			-	triclopyr	quinclorac	dicamba	fluroxypyr
HRAC MOA Groups 2, 27	Nontreated	-	NTC	TEU	DRI	VAN	VIS
	Sapphire	penoxsulam	SAP	SAP + TEU	SAP + DRI	SAP + VAN	SAP + VIS
	Tenacity	mesotrione	TEN	TEN + TEU	TEN + DRI	TEN + VAN	TEN + VIS
	Pylex	topramezone	PYL	PYL + TEU	PYL + DRI	PYL + VAN	PYL + VIS
		Legend	*nontreated*		*standalones*		*tank-mixes*

Application codes (timing):

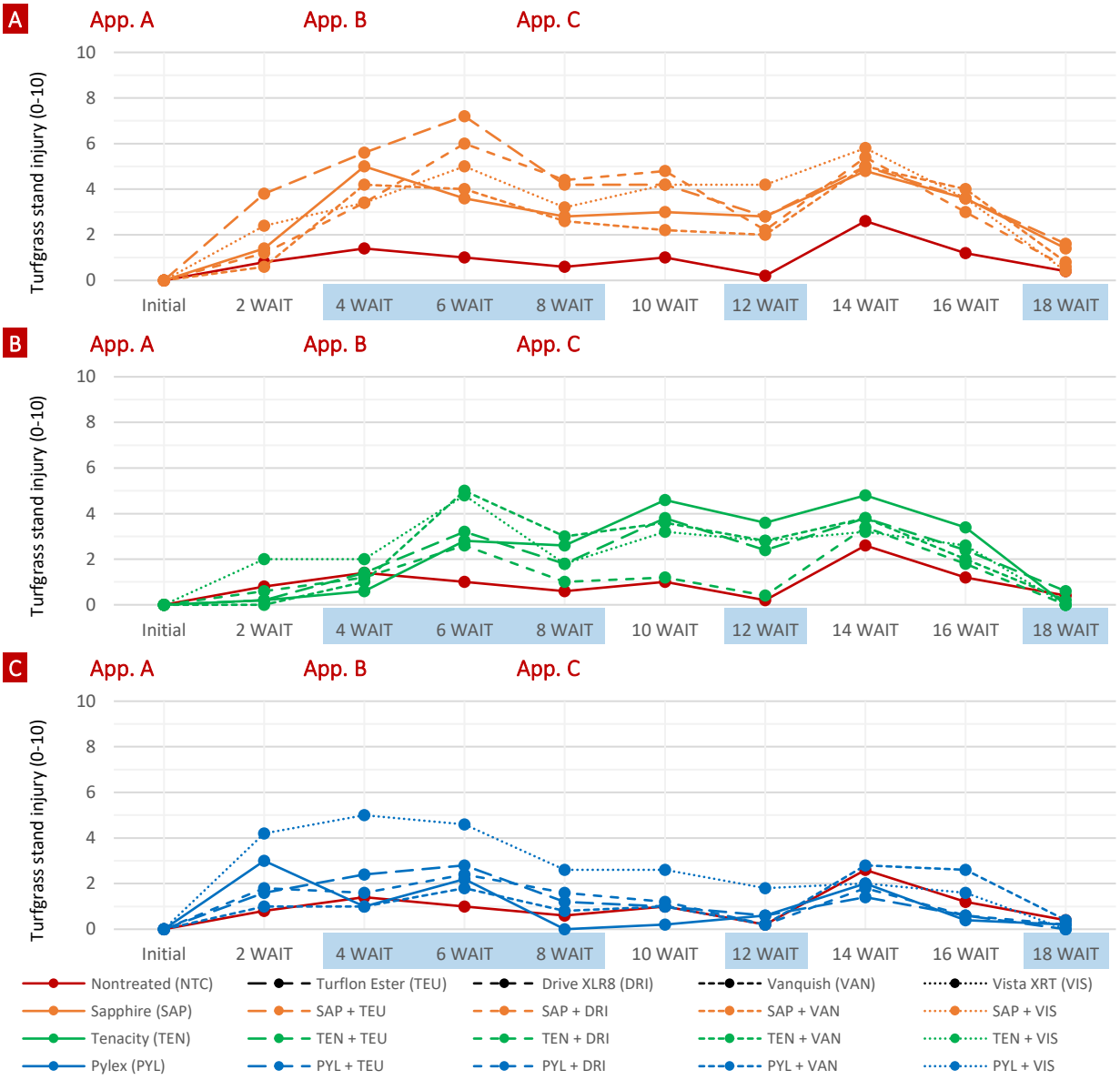
A – 09/30/2020 B – 10/27/2020 C – 11/24/2020

Figure 1. General view of the study area showing target weed pressure prior to application of treatments. Photo taken by P. Petelewicz on September 29, 2020. Napa, CA.



* On timings marked with blue color, English daisy control was significantly higher in treated plots, when compared to nontreated control (*P*=0.05).

Figure 2. The effect of (A) all standalone postemergence herbicide treatment and treatments containing (B) Sapphire at 0.5 pint/A, (C) Tenacity at 5 oz/A, and (D) Pylex at 1 oz/A on English daisy control (0-100%). Napa Golf Course, Napa, CA. 2020.



* On timings marked with blue color, English daisy control was significantly higher in treated plots, when compared to nontreated control (*P*=0.05).

Figure 3. The effect of treatments containing (A) Sapphire at 0.5 pint/A, (B) Tenacity at 5 oz/A, and (C) Pylex at 1 oz/A on desired turfgrass stand injury (0-10). Napa Golf Course, Napa, CA. 2020.

Figure 4. English daisy cover in nontreated control plots at study initiation on September 30, 2020 (left), at 8 weeks after initial treatment (WAIT) on November 24, 2020 (center), and at 16 WAIT on January 20, 2021 (right). Photos taken by P. Petelewicz. 2020-21. Napa Golf Course, Napa, CA. 2020.

Figure 5. English daisy cover in plots treated with Sapphire alone at 0.5 pint/A at study initiation on September 30, 2020 (left), at 8 weeks after initial treatment (WAIT) on November 24, 2020 (center), and at 16 WAIT on January 20, 2021 (right). Photos taken by P. Petelewicz. 2020-21. Napa Golf Course, Napa, CA. 2020.

Figure 6. English daisy cover in plots treated with Tenacity alone at 5.0 oz/A at study initiation on September 30, 2020 (left), at 8 weeks after initial treatment (WAIT) on November 24, 2020 (center), and at 16 WAIT on January 20, 2021 (right). Photos taken by P. Petelewicz. 2020-21. Napa Golf Course, Napa, CA. 2020.

Figure 7. English daisy cover in plots treated with Pylex alone at 1.0 oz/A at study initiation on September 30, 2020 (left), at 8 weeks after initial treatment (WAIT) on November 24, 2020 (center), and at 16 WAIT on January 20, 2021 (right). Photos taken by P. Petelewicz. 2020-21. Napa Golf Course, Napa, CA. 2020.