RAIN N GRAIN & STUBBLE; A PROACTIVE APPROACH TO WEED CONTROL: OUT OF CROP WEED CONTROL.

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GRDC project CWF00018 Maintaining profitable farming systems with retained stubble in Central West NSW.

Outcomes of the CWFS and NSW DPI, GRDC funded, research project: Wheat fallow efficiency x nitrogen trial, clearly showed the benefits of fallow weed control with a 38% increase in grain yield as a result of fallow weed control (Menz et al 2012). Controlling weeds within a cropping area has clearly demonstrated benefits. However, can weed management outside a cropping area provide benefits to growers in terms of lower weed burden, pest & disease risk within crop fields and an associated reduction in herbicide & pesticide inputs with an increase in economic returns?

THE SIMPLE ANSWER IS: YES.

Weeds external to a cropping area (ie; along fence lines and roadways) are a known problem. They impact negatively upon a cropping operation in a number of ways; ie,

- Pest insects - Weeds can provide refuge for insect pests and act as a point source of distribution into a cropping area.
- Diseases - Weeds can act as a host for crop disease. When an infected weed is fed upon by a pest insect (e.g. aphid) and the pest insect then feeds upon a plant within a cropping zone the disease is transferred to the crop.
- Seed - Weeds external to a cropping zone provide a source of seed that can enter and infest a cropping area.
- Mice - Weeds external to a cropping area provide food, moisture and refuge for mice.
- Herbicide resistance - Weeds external to a cropping area do not generally receive the same levels of control as weeds within a cropping area, which can assist in the development of herbicide resistance.
- Green bridge - Weeds that perpetuate external to a cropping season provide what is termed as a “green-bridge”. This green bridge is known to enable pest insects and diseases to survive as well as provide a source of weed seed for future in-crop infestations.

PESTS; INSECTS AND MICE

Mice are known pests of cropping operations within Australia with losses from the 1993 mouse plague conservatively estimated at costing 64.5 million dollars in Victoria and South Australia alone (Caughley et al. 1994) Mice are known to impact upon crops a number of manners; they dig out newly planted or germinating seeds (Brown et al. 2003) attack developing tillers and heads, and at the grain development stage damage tillers and consume grain (Brown, 2007). Weeds along fence lines and roadways provide key areas for refuge and breeding. Spring control of weeds along these areas has been demonstrated to provide a cost effective method of mouse control via reducing breeding success and subsequent invasion of crops (Brown, 2007). The preferential colonization of these areas in spring was clearly shown via 2014 CWFS mouse monitoring activities.

Pest insects are known to have preferred host weed spp – which in some situations can be quite extensive. For example the Green Peach Aphids (an important vector of the Beet Western Yellow Virus) preferred weed hosts include; wild radish, wild turnip, capeweed, volunteer canola & lupin's (GRDC, 2014), bitter melon, fleabane, stink weed, and blackberry night shade (Freeman & Aftab 2011). The Green Peach Aphid has developed more resistance to insecticides than any other insect (GRDC, 2014). Controlling the weeds that surround a cropping area that enable a pest to perpetuate is an important component of a cropping systems Integrated Pest Management approach (Schellhorne et al 2010).

Take home message; remove the pest's source of food and habitat and you reduce the potential in-crop impact of the pest.

DISEASES

Weeds external to a cropping area are known to harbor diseases that impact upon agricultural crops (Freeman & Aftab, 2011). For example; Beet western yellows virus, Turnip mosaic virus and the Cauliflower mosaic virus have the potential to impact negatively upon canola and other Brassica spp. These viruses are only able to survive between growing seasons by using weeds as hosts (NSWDPI & GRDC, 2014).

Take home message; control weeds external to a cropping area and reduce the incidence of disease transfer between growing seasons.

HERBICIDE RESISTANCE

Herbicide resistant weed species are found throughout all Australian cropping systems and their numbers are increasing (Agric, 2014). Control of weeds external to a cropping area is an important method of ad-dressing this serious issue. Often weeds external to a cropping zone are not subject to the same level of attention as weeds within a cropping area, with herbicide applications generally applied later in the growing season when the weeds are larger, more robust and harder to achieve thorough herbicide coverage upon. Individual weeds that are not controlled via herbicide applications are also less likely to receive fol-low up control measures (Weedsmart, 2014(a). Once herbicide resistant weeds establish on paddock borders seed can easily spread into a cropping area via wind, water or machinery and hinder in-crop weed control.

Take home message: timely, targeted management and follow up control methods for out of crop weeds will reduce the risk of herbicide resistance occurring.

TIMING – WHEN TO CONTROL

Each factor relating to out of crop weeds; ie, pests, diseases, herbicide resistance, has a preferred timing for application of control methods. For example: effective control of mice populations has been demonstrated to be achieved via spring weed control (Brown, 2004); Abbas & Rana et al (2012) demonstrated that if weeds were controlled at an incorrect seasonal timing, insect pest species can be driven into an adjacent crop causing damage which would have otherwise not been experienced, if weeds are controlled at the appropriate time, the risk of plant borne diseases and their insects vector can be effectively reduced (Freeman & Aftab 2011); to address herbicide resistance, efforts to prevent seed set are an important consideration with herbicide applications to be best conducted in May when the weeds are smaller rather than later in the winter growing season when the weeds are larger, with a further follow up application later in the season required to address late germinations (Weedsmart (a).

Take home message: ongoing control of out of crop weeds is required to facilitate effective outcomes in controlling weeds pests and diseases.

HOW TO CONTROL

The concept of integrated weed management identifies a number of "tools" to address weeds external to a cropping area. These include chemical (ie; herbicide), cultural (ie; burning, native revegetation of fence lines) mechanical (ie; cultivation) and biological control methods (ie; grazing, introduced control spp) (Sharma, 2014). Variation in the economic benefits of weed control methods can be experienced due to the individual situation where it is to be applied. (i.e. Tabatabaekoloor et al 2012., Verma et al, 2013., & Schellhorn et al, 2010). However addressing weed populations when at their most vulnerable so as to prevent seed set, and consequent population perpetuation, via using a combination of these approaches (ie; double herbicide knock downs, grazing followed by cultivation etc.) will provide effective outcomes (CRC, 2006).

T*ake home message: a variety of control options exist and the economic implications and benefits must be investigated and applied on a situational basis.*

ECONOMIC BENEFITS OF CONTROL

The total combined economic benefit of controlling weeds external to a cropping area; with regards to pests, diseases, prevention of herbicide resistance and spread of weeds to a cropping zone, is uncertain. However to provide an indication, during 2004-2005 weed-related issues affected 73% of Australian agricultural enterprises and it is estimated that weeds cost Australian farmers around $1.5 billion a year in weed control activities and a further $2.5 billion a year in lost agricultural production (Dept of Environment, 2014). On average, crop disease costs the Western Australian grains industry an estimated $500 million in lost production (DAFWA, 2014) and invertebrate pests cost Australian agriculture around A$500 million in lost production each year (CSIRO, 2013). As demonstrated in previous sections; control of weeds external to a cropping area is an important component in addressing each of these factors and therefore provides a direct combined economic benefit to the Australian Grains industry as a whole.

Take home message: control of weeds external to a cropping zone is an important economic consideration that will not only benefit individual farms, but the Australian Grains industry as a whole.

Although weeds external to a cropping area may seem not to be as important as the weeds within a cropping area - they are. Applying effective measures to control these weeds will not only reduce the in-crop impact of weeds but also reduce the incrop impact of pests, diseases, herbicide resistance.

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