

MANAGEMENT PLAN  
FOR  
EMEX AUSTRALIS &/OR  
E. spinosa

## STEP I

Initial recognition of problem and scale of problem. Preparation of Rational for Management. In this case already decided as:

- a) containment in New South Wales
- b) control in pastures
  - rangeland
  - wheatfields
  - non crop land

## Plant Profile

Polygonaceae

Emex australis steinh.

Emex spinosa Campd.

Common Names - Doublegee  
three corner jack

## Origin South Africa

Introduced 1830

First reported 1883.

## Weed Status

Prolific Seed Production

Rapid competitive growth equals loss of production, crops and pasture.

Spiny seeds equals lameness infection and in some cases death for sheep and cattle.

Adapted to broad range of environmental conditions.

Competes for water, plant nutrients particularly Nitrogen.

Sheep dogs injured.

Contaminates hay, grains, pasture, oats, and dollar losses related to density.

## Plant annual

Seed germinates Autumn and early winter.

Some seed stays dormant until cultivation.

Seed production under unfavourable conditions.

Rosette of six to eight large spade shaped leaves.

Strong tap root.

Hollow fleshy stems up to two feet long.

Fruits, hard, woody, triangular shaped.

High N requirement.

Preference for light sandy soils but has fairly high water demand.

Spread by a) animals b) equipment c) water.

## Range and Spread

Some conflict appears between the statements concerning need for containment and 150 years that have elapsed since introduction indicating a possible stabilization of range but increasing frequency/density because of changing farm practice in the form of fertilization and irrigation. Resolution of this conflict should predicate the level and urgency afforded the problem.

The 1966 survey already indicates high concentrations on the border with neighboring states which would suggest that containment is already of doubtful use. However, within New South Wales distribution and occurrence would appear to relate in some part to water demand on the part of Emex since most concentrations follow river valleys. Further since it is a winter germinating annual in Australia with a South African origin it may well be limited by adverse winter climatic conditions.

## STEP II

It is necessary to resolve the conflicts of Responsibility, Funding, Priority and Urgency. At what level should the problem be addressed; individual, cooperative, municipal, State or Federal? Who will provide funds, to what extent, and for what purpose? Since the Emex is now a state wide problem it would seem reasonable to designate State as lead agency and presume that the appropriate department of government has had the insight to budget some funds and that the political climate is such that the Treasury Board has approved them.

### General Plan Year 1

#### Initial Meeting

A number of initial meetings of senior government staff, university personnel, growers representatives, chemical companies and appropriate government departments for example agriculture, economics, environment, wildlife, occupational health and veterinary science will be necessary to resolve conflicts of interest, solicit ideas and set short term goals and objectives. This should be the formation of an initial advisory group and the setting up of communication channels. A review will be necessary of existing resources.

Reason:

Good common sense - do not ride off in all directions at once to the dismay of others and eventual embarrassment of self. Stress team effort.

#### Survey

A state wide survey possibly with I/R False Colour by air if possible with appropriate ground truthing.

Reason:

Last survey 1966 by District Agronomists. Need now up-to-date uniform information on distribution and intensity of infestations. Such a survey will form the basis of detailed ground maps, setting of priorities, assignment of responsibilities, determination of logistics and work load etc. etc.

#### Historical Review

A historical review of the past practices.

Reason:

An analysis is needed regarding control measures used to date, cost effectiveness, annual spread of the weed and dynamics of the problem. e.g., increasing, stable or decreasing. Applicability of any existing legislation and effectiveness.

### Economic Analysis

A full economic analysis should be conducted on a state wide level.

Reason:

Continued funding and public education needs, require clear picture of individual, State, and National impacts of the plant. Social and environmental analysis require this component as does cost/benefit and risk/benefit analysis of control methods.

### Research

Research will be required on the biology of the plant, its taxonomy and phenology, genetics and ecological requirements if this data is not already complete. Initial work may begin on the possibilities of biological control as Emex is introduced from South Africa. The plant is already a serious range weed in Hawaii and Apion species have been introduced from South Africa and Morocco. Liaison should be established with groups there and in the country of origin. Since biologic control has already proven successful in Australia-some resources and expertese should be still available. A detailed literature review may be initiated. Preliminary work on a translocated herbicide suitable for range, crop and non crop land situations should be undertaken since both presently effective herbicides are of the contact type. In addition soil s materials should be investigated for industrial sites. Some biochemical work may be justified to determine why only two contact Herbicides available from the wide range of materials presently available, effect the plant. It will be necessary to determine if these two materials are registered for the uses intended in Emex control.

Reason:

To be forewarned is to be forearmed.

### Public Involvement

Limited public education until full dynamics of the problem illucidated. Probably continuing past level of involvement mainly at the grower level stressing control and management procedures. Continuing with previously available literature. Soliciting field information from growers and grower groups. Locating those growers who by good practice have reduced their individual problem. Possibly initiate a show by example program at the local level. Initiate good communication channels.

Reason:

Gradual programs needed until all factors fully known.

### Staff Involvement

Meetings internally for coordination and awareness plus cross fertilization of ideas.

Reason:

So that communication continues and all staff are kept advised of information that has been generated, decisions made and rational for such decisions.

### Position Paper

A review should be prepared of all data collected, data gaps, priorities approach philosophies, alternatives, constraints, responsibilities, logistics and work load, budgets, training needs, safety needs, personnel implications, etc. etc.

Reason:

So that clear Program Priorities can be established for:

1. responsibilities
2. goals
3. objectives
4. time targets
5. budget controls

### STEP III - YEAR 2

#### Political Involvement

On the basis that the weed is of National importance liaison should be initiated between National and State political bodies and individuals. The weed should perhaps be added to a National ten most (un) Wanted Weeds Program. A summary of the position paper should be made available.

Reason:

Political support will be needed for future funding, smooth inter-agency coordination and possibly later legislative controls.

#### Survey Data Application

On the basis of previous survey and data on reproductive success, spread and land ownership determine possible intensities of infestation and proportion of area in each land use type:

1. range
2. pasture
3. grain crops
4. industrial sites
5. miscellaneous

Detailed maps prepared and a program for the worst areas developed, taking into account political pressures and environmental constraints.

Reason:

Normally resources are limited, best to start where most effective first.

#### Public Involvement

Moved to a more progressive public program especially in areas of heavy infestations.

1. General public - awareness of spread  
control measures proposed  
erradication from industrial and residential sites  
sources for advise and assistance

2. Farmers - Detail of literature with coloured photographs of different stages of weed development from seedling to mature plant. Farm show discussion on radio and T.V. clear presentation of economic implications, stock health, control measures, costs and cost sharing programs availability of Extension advise presentation of good farmer examples.
3. Applicators and Industry - Training hazards, legislation, government assistance and monitoring programs, chemical supply needs etc. etc.

Reason:

Full cooperation and understanding required to make program successful.

#### Administrative Involvement

Staff compliment, job descriptions and work loads for new program must not be disruptive vis a vis existing programs. Where possible should be complimentary. Life span of program should be clear as should be responsibilities, priorities, objectives etc. as per Position Paper.

Reason:

Government is normally slow to react and easily thrown into mass confusion.

#### Control Strategies

An allocation of resources especially funds and expertise will be required depending on responsibilities and objectives. The following may be equitable:

1. Public land - public grazing  
right-of-ways  
derelict land  
forest land  
Government bodies responsible
2. Food production lands - direct  
wheat etc. Joint New S. Wales state and  
farmers ratio 30/70
3. Food production lands - indirect  
grazing and range land Joint New S.  
Wales state and  
farmers ratio 70/30

Reason:

The direct benefits from increased yield on grain crops will be gathered by individuals or co-ops and according to the handout costs will cover themselves. The financial incentives from government should not provide undue profit for these individuals but must still be an inducement to participate in the program. On the other hand return from grazing land is generally poor per unit area and the subsidy should be corresponding larger to insure good success. Public land will have to be managed using funds from the public Treasury.

#### Control Methods

### Non-Crop Land

Rights-of-way, industrial areas, known farm areas, around buildings, storage areas etc., river banks, roads, ditches, water impoundment areas, and like places; the use of Paraquat as a spot treatment would be initially recommended until soil sterilents or selected herbicides became available.

#### Reason:

Spot treatment is recommended as paraquat is a non-selective contact herbicide of high cost. It is also not as toxic to fish as Dinoseb and has short residual. Precautions and training will however be needed regarding use and handling because of mammalian toxicity. This program would be actively pursued in order to reduce the reservoir of Emex particularly in those areas where the spiny seed may be carried by water or vehicles. The diversity and acreage involved with such locations, environmental and administrative conditions, along with the doubtful worth of other mechanical methods given the seed type and root structure would also support the use of this chemical. The limit on staff available high labour cost, and the probable need for maximum response in the period between germination but before seeding would indicate chemical control as the most suitable initial method of reducing infestations and spread from one area to others by vehicles, farm equipment, water or wildlife. In the longer term use of effective soil sterilents where appropriate, seeding of bare ground to reduce infestations and biological control if proven effective may stabilize the spread and development of the weed. Any later developments which might allow the use of a selective herbicide which would be incorporated with or a replacement for on going weed control, may allow a return to normal maintenance cycles and procedures.

### Pasture

The interaction between Emex growth density and spread and irrigated pasture would have to be established. The conditions which encourage the plant and the extent of pasture renovation programs would require documentation. Where appropriate Dinoseb might be considered for an early spring application on established grass but not in irrigated or very damp areas since the material leaches readily and is toxic to fish. Treatments should be undertaken before the Emex reaches the rosette stage. One treatment two weeks apart may be appropriate. Such treatments will have a detrimental effect on annual grasses and may reduce grass stands. These treatments should be followed by fall seeding to establish good stands before the following spring. Control should extend into fence rows to reduce that weed source. In adjoining following land the same treatment may be warranted to reduce these areas as a reservoir of germinating Emex seeds.

In irrigated and heavily fertilized pasture not badly infested spot treatment with Paraquat of plants in early spring before flowering may be successful. In badly infested pastures plowing and harrowing followed by reseeding and preemergent treatment of Dinoseb may be possible followed by spot treatment with Paraquat as required. In areas primarily used for Lucerne normally a spring seeded crop it would seem best to plow, disc and harrow the area and treat the fall germinating Emex with two treatments

of Dinoseb a month apart. In established fields head lands, fence rows, and weed hot spots could be spot treated with Paraquate as necessary before the weed flowers.

Management of grazing and all these situations will be necessary so that areas do not become over grazed and thus open to greater infestation of the weed brought in from other areas. Careful attention will be necessary to ensure that herd or flock rotation does not mean that "clean areas" are contaminated by stock carrying seeds from "unclean areas". Paddock stock should not be fed contaminated lucerne or pasture hay. Animals should be excluded from badly infested areas because of health hazard and transportation of seed.

Since a number of pasture areas are in valley bottoms and presumably fairly wet in late Autumn and early Spring there may be some benefit in improving drainage where appropriate. This may reduce the water table without doing undue damage to the pasture grass yet depriving the weed of essential moisture before the tap root has developed.

Reason:

Pasture renovation with Paraquat would be extremely expensive because of high chemical cost. Further the lag time before the pasture recovers and becomes reusable is probably longer than would be the case with the above recommendations except where the pasture is badly infested. Comparative costing of methods and time loss would be required. Manipulation of irrigation timing would not seem to markedly alter the weeds ability to produce seed, however, the winter use of nitrogenous applications of fertilizer obviously have an impact on the plants success. It may however be desirable to continue fertilizing yet coupling this with a Dinoseb treatment of germinated plants and spring reseeding. There may be some benefit in recommending Autumn rather than Winter application of the fertilizer and a cessation of late Fall grazing which would contribute to pasture entering the winter season in poor condition.

### Cereal Crops

A detailed analysis would be required of cropping practice, market potentials and profits available from various systems. This writer knows very little about farming practice or alternatives and hesitates to make any suggestions without more knowledge. As timing is always a crucial component of effective control it will be necessary to have a better understanding. Although the summary notes that seeds germinate in Autumn and early Winter it is not clear how long it takes for the rosette stage to be complete nor it follows when flowering takes place. It would certainly seem Spring sown crops require protection from the previous Fall or better still were the subject of Fall planting. In the former case it would be possible to have a winter fallow but treat with Dinoseb after cultivation has caused as many Emex possible to germinate. Two treatments might be considered a month apart with top tilling and sowing in the spring. In the latter case it would seem impossible to have a Fall sowing using Dinoseb as a preemergent control with suitable follow up spot treatments along fench rows etc. as required with Paraquat.

Reason:

Since neither herbicide is suitable for use in mature wheat crops it will be necessary to manipulate timing seeding and cropping practice to fit the most vulnerable stage of the weed. It certainly seems worthwhile to pursue this aspect of weed control since it is indicated that higher yields may be demonstrated quickly and infestations over quite a wide area could be reduced substantially.

Range Lands

Little mention is made of the plant infesting range lands and this may in part be due to its high water demand. Range land is normally a land use which occurs on poor productivity sites with lower rainfall conditions presumably undesirable for the spread of Emex despite the normally poor return associated with range land weed control programs. Fairly substantial funding is envisaged from the government support program. This would enable two programmes to be instituted on range land depending on the intensity of infestation. Very bad sources of the weed could be burnt and reseeded or where burning is not feasible or desirable as in the case of organic soils range land renovation using Parquat applied from the air and immediately followed by reseeded may be considered. An intensive program in one year properly organized and with government support could substantially reduce areas of severe infestation particularly if the program can be incorporated with other range land improvement such as on going seeding and fertilizing programs. Detailed mapping would be required for a cost effective program. Since Emex would appear to be fairly successful range land invader precautions would have to be taken against further spread of the weed, fencing of badly infected areas may be possible though costly until treatment is effected particularly since the seeds are woody and presumably fairly durable. In this regard restrictions on early spring grazing would not necessarily provide restricted spread since any time during the summer stock could move viable seed. In the case of sheep whose fleece may be able to transport the seed restrictions may be necessary on the disposal of tags. In areas of less severe infestations controls on over grazing, attention to reseeded and fertilizing areas probably be given prominence. In the long term once infestations have decreased through herbicide control and cultural practice it may be possible to effect a stabilization of a plant through the use of biological control agents.

Reason:

Although the return from range land weed control may not be substantial it is necessary to undertake the fairly comprehensive program since contaminated areas will continue to be a reservoir for seed spread both by water and ectozoochory.

Monitoring

There should be an effective monitoring program to assess effectiveness of field treatment and supervision of assisted programs. Experience, costing and effectiveness should be catalogued for incorporation in the next years program. Environmental integrity will require study and surveillance as will all non-integrated changes in practice on other pest problems and weed species.

Reason:

It is necessary to know where you have come home, where you are and where you are going.

Research

There will be a continued need for on-going research started in Step I with both in-feed and out-feed of information. Studies on plant biology success, dispersal ability and reasons for present range should be beginning to provide useful data for incorporation in control programs. The results from field trials and experimentation should, where possible be incorporated in on-going programs. Site indexing of areas susceptible to but not yet invaded should begin at this stage.

Reason:

On going research will be necessary as more information is generated and the broader picture begins to reveal itself. Basic and applied research should have the clear goals of improvement of field conditions.

Legislation

The effectiveness of management systems should be supplemented with incentives where necessary. The use of legislation though good in theory is no substitute for field work, grower or public acceptance. It may however have a place in:

- 1) prohibiting further introductions on a national basis
- 2) on a local level, keeping the spread of, for example, contaminated fodder being moved from one place to another.
- 3) on a state basis prohibiting the distribution of contaminated fodder, equipment or animal products such as fleeces. May also restrict and uses as in the case of shoddy being used for fertilizer.
- 4) providing a legal backdrop for enforcement of regulations governing the above.
- 5) provide a mechanism for financing programs.

Reason:

If the problem is not expanding rapidly and the control procedures are relatively effective the formal enactment of major new legislation may not be necessary at the state level. Experience and needs will dictate.

Yearly Summary

The review of successes are otherwise especially of integration of various methods were appropriate should be catalogued for future dissemination. A statistical and economic summary of the previous years work should be compiled. The problems or successes of control methods, communications, public meetings etc. etc. should be discussed.

Reason:

Re-examination of past objectives, a review of target attainment and viability of the whole program should be evaluated at this stage such a report will also form the basis for preparation of detailed plans for the following year.

## STEP IV - YEAR 3 AND ON GOING YEARS

### Program Continuation

All facets of program continuation at an appropriate intensity and with modifications based on the previous years experience should be laid out. There should be an assessment of needs in areas of less than severe intensity since these latter areas should now be showing substantial reduction in Emex occurrence.

Reason:

Now is the time that all good men etc. etc.!

### New Survey

A complete evaluation of impact of the previous years and on-going control programs should be undertaken using the methods derived from the first survey in order that comparative data may be assessed. Wherever possible preliminary trends should be established.

Reason:

By Year III it should be possible to have some indication as regards to success of program so far. There will however be variation introduced by different climatic conditions and normalization of data generated will be necessary at this stage.

### Research

There will be an on going need for application of data and findings generated by researchers Field Staff, Associated Professions and the growers themselves. In the longer term the biological control agents may reach a stage for field testing release and possible establishment. There may hopefully be a maintenance of low levels of infestation resulting from a reduction by all on going procedures cultural, chemical, and common sense.

### Retirement

Having developed a successful selective herbicide which will not only control Emex but also replace most other presently available herbicides in farm use and having successfully fought the anti chemical lobby by showing that it is completely harmless in the environment and having taken the precaution of acquiring the patent rights to the material the writer feels justified in retiring on the proceeds.

Reason:

All's well that ends well.