INFECTION TO PROTECTION

NET FORM NET BLOTCH

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This page expands on the key concepts introduced in the 'Infection to Protection-net form net blotch' information sheet, providing further detail on net form net blotch (NFNB), including early symptoms, where to look for these symptoms, recommended monitoring practices and further information on the importance of early detection.

We've provided these additional explanations and supporting information to provide more detail on NFNB, highlighting its relevance to barley production and resources which may be useful at mid-season.

This guide is intended as a general grower resource and is based on published information available at the time of writing. Recommendations may change as new research, product registrations, and resistance information become available. It should not be relied upon as a substitute for independent professional advice.

Fungicide timing

Applying a fungicide at optimal timing helps prevent or delay disease development and protects yield, maximising the effectiveness of application. Multiple factors influence fungicide timing considerations, including plant growth stage, level of disease, pathogen, and application requirements (e.g., environmental conditions) (Mueller, et al., 2021). Many fungicides have a limited period of activity after application, therefore applying too early in the growing season, particularly in the absence of confirmed disease risk may result in not enough active ingredients remaining in the plant when disease onset occurs (Mueller, et al., 2021). The most effective fungicide strategy corresponds with both the key growth stages of barley and timing of disease outbreak, highlighting the importance of routinely monitoring crops to enable timely application.

The top 3-4 leaves of the crop canopy, along with the flag leaf sheath and head are responsible for the photosynthetic capacity which contributes to grain fill and yield (Poole & Arnaudin, 2014). Fungicide applied at first-second node (GS31-GS32) and flag leaf emergence (GS39) are important as they protect the key leaves before infection (Poole & Arnaudin, 2014).

Fungicide timing- continued

More than two applications of fungicide may be necessary to minimise yield loss when infection levels are high, highlighting the importance of a seed treatment at the beginning of the season for crop protection, which is a critical for protecting the seed and young seedling from soil and seed borne diseases (Ayesha, et al., 2021). A 'head wash' application at GS59 can also be considered if follow up applications are required to extend protection and protect grain quality. A head wash application should only be necessary in seasons where high levels of disease are found, and a wet finish is predicted. It is important to consult with an agronomist and refer to product label, particularly concerning plant maximum residue limits (MRLs). The label may also provide guidance on the optimal timing of fungicide applications, along with tools including NetBlotchBM which is a decision support tool to assist in determining the best management strategy to reduce net form net blotch.

Product choice

To maximise the effectiveness of fungicide applications, it is important for growers to choose a product suited to the target disease and apply it at the right time and at label-recommended rates (Leys, 2026). When selecting a fungicide, it is important to consider the following factors:

- **Target disease.** Accurate disease identification is essential when selecting the right fungicide product. Multiple diseases may be present in the crop; therefore, it is important to choose a fungicide that provides effective control of the target disease(s).
- **Existing disease pressure and the potential risk of disease development.** Disease severity at the time of application and the risk of further disease development should guide fungicide selection, monitoring seasonal conditions and the use disease forecasting tools can assist with product choice (Leys, 2026).
- **Active ingredient and mode of action (MoA).** Consider excluding fungicides that contain stand-alone actives, as using mixtures reduces fungicide selection pressure (Table 1).
- **Method of fungicide application.** The ideal method depends on the target pathogen, crop stage and fungicide type.
- **Regional resistance status.** Fungicide choice needs to be strategic, selecting fungicides with little or no resistance reported in the region is key for better control. When reduced sensitivity or resistance has developed, minimise the use of affected fungicide groups. Reduced sensitivity occurs when application does not work optimally but does not completely fail, whilst resistance occurs when fungicide fails to provide an acceptable level of control of the target pathogen (D'Souza, et al., 2026).

Product choice - continued

Table 1. Examples foliar fungicide products registered in SA for NFNB in barley, including active ingredients and fungicide group classifications.

Product	Active	Fungicide group
AMISTAR XTRA	Cyproconazole Azoxystrobin	Group 3 Group 11
Aviator XPRO	Prothioconazole Bixafen	Group 3 Group 7
ELATUS ACE	Benzovindiflupyr Propiconazole	Group 7 Group 3
EPOXISTAR 125 SC	Epoxiconazole	Group 3
MAXENTIS OPTI	Azoxystrobin Prothioconazole	Group 11 Group 3
OPERA	Epoxiconazole Pyraclostrobin	Group 3 Group 11
PROSARO PROTEB 420	Prothioconazole Tebuconazole	Group 3
RADIAL OPTI	Epoxiconazole Azoxystrobin	Group 3 Group 11
REVYSTAR	Fluxapyroxad Mefentrifluconazole	Group 7 Group 3
SOPRANO 500	Epoxiconazole	Group 3
TAZER XPERT	Epoxiconazole Azoxystrobin	Group 3 Group 11
VERITAS OPTI	Tebuconazole Azoxystrobin	Group 3 Group 11

Resistance management

Fungicide resistance occurs when a fungicide that was once effective no longer controls disease, even when applied correctly. This arises due to the fungal population becoming resistant through selection pressure. As a pathogen population presents less sensitivity to a fungicide product, the product becomes less effective for disease management (Mueller, et al., 2021). This becomes a major limitation for disease control, restricting the range of fungicide products available for effective management. Therefore, it is important to incorporate a combination of resistance management strategies into fungicide use, alongside other disease management practices.

For control of net form net blotch (NFNB) of barley there are three registered fungicide groups; Group 3, Group 7 and Group 11. Group 3 fungicides are demethylation inhibitors (DMIs); broad spectrum fungicides which work by disrupting the membrane and organelles of fungal cells after spores have germinated (Crop Science Bayer, 2025). Group 7 fungicides are Succinate Dehydrogenase Inhibitors (SDHIs) which provide a relatively narrow spectrum of disease control compared to other fungicides. The mode of action is the inhibition of cellular respiration and energy production within the fungal mitochondria (Crop Science Bayer, 2025). Group 11 fungicides are known as Quinone outside Inhibitors (Qol) or strobilurins and are single site MoA chemicals which limit fungi energy production (Crop Science Bayer, 2025).

Resistance and reduced sensitivity to all three fungicide groups registered for NFNB have been detected across Australia, through both field and laboratory testing. Double and triple mutants have also emerged. Reports of reduced fungicide efficacy and control failures associated with double mutants have been reported in South Australia, Victoria and Western Australia (D'Souza, et al., 2026). In addition, isolates carrying mutations that show resistance or reduced sensitivity to all three registered fungicide groups have been identified (D'Souza, et al., 2026). These developments highlight the role of an effective integrated disease management strategy to minimise the emergence of additional fungicide resistance.

Resistance management strategies for NFNB include:

- If resistance is present in the growing region, avoid S and VS varieties of barley. If growing susceptible varieties, monitor crops closely and be prepared to apply timely fungicides.
- Ensure correct diagnosis to avoid unnecessary fungicide applications.
- Have samples tested if resistance is suspected to ensure the crop can be effectively managed.
- Spray only if necessary and apply strategically. Applications should be timed to be the most effective for disease management (Mueller, et al., 2021).
- Rotate and mix fungicide mode of action (MoA). Use different modes of action when more than one fungicide application is needed during a season.
- Where reduced sensitivity or resistance has developed, minimise and if possible, avoid the use of affected fungicide groups, especially when this development is local (D'Souza, et al., 2026).
- Always follow fungicide labels; some may feature a resistance management section which should be followed carefully (Mueller, et al., 2021).
- Monitor disease progression following fungicide application; this is a way to check for potential fungicide resistance.
- Remove or reduce stubble loads to minimise carryover of stubble-borne pathogens.

Economic impacts

Fungicide use increases production costs. Matching specific products to manage specific diseases is essential for optimal results. The effectiveness of fungicide applications depends on the amount of disease pressure, level of varietal resistance and pathogen resistance to applied fungicide (DPIRD, 2024). The point at which a fungicide application is economically viable depends on the cost of application and the potential yield loss. Net form net blotch (NFNB) is an economically significant disease of barley due to reported yield losses of over 30% (Ellwood & Wallwork, 2019). In addition to yield losses, NFNB can cause substantial quality losses leading to grain downgrades (Olita, et al., 2023).

Across Australia fungicides are the main control for NFNB, due to their low cost and effective management of NFNB. However, when used repeatedly, fungicides create selection pressure for tolerant strains, which is currently happening in Australia where resistance and reduced sensitivity to all three fungicide groups registered for NFNB has been detected. This is when fungicide use becomes more costly and may result in the cost associated with managing the disease outweighing the benefits (Olita, et al., 2023). The presence of fungicide resistant strains of NFNB and reduced efficacy of multiple fungicide MoA groups presents a significant economic risk for the Australian barley industry and disease management (Olita, et al., 2023).

Ultimately, the economic impact of NFNB management is determined by the incorporation of integrated disease management (IDM) into a cropping system, along with fungicide use and the integration of appropriate product selection, timely fungicide applications, and effective resistance management. These factors can maximise disease control, protect yield and grain quality and prolong fungicide efficacy, minimising the economic risk associated with NFNB in barley.

Additional resources

NetBlotchBM- Decision support tool
https://www.dpird.wa.gov.au/online-tools/netblotchBM/

Fungicide resistance portal
https://prim.ccdm.com.au/home

Australian fungicide resistance extension network pyramid
https://www.youtube.com/watch?v=lOgVqsCPxH8&t=3s

Fungicide resistance AFREN
https://afren.com.au/understanding/

Decision support tools aid disease management decisions
https://groundcover.grdc.com.au/weeds-pests-diseases/diseases/decision-support-tools-aid-disease-management-decisions

Fungicide resistance management in Australian grain crops
https://afren.com.au/wp-content/uploads/2026/02/fungicide-resistance-management-in-australian-grain-crops-afren-grdc-20260101-web.pdf

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